jpl

ENGINEERING PLANNING DOCUMENT

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

FIM

FIELD INSTRUCTION MEMORANDUM

MISSION P-36 (RA-5)

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FIELD INSTRUCTION MEMORANDUM

C O N T E N T S

FIELD INSTRUCTION MEMORANDUM

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1. INTRODUCTION

A. General

JPL operations covering the P-36 mission are given by four related but independently published documents, the AOP, SFOP, and TIM. The general plan by which the JPL/AMR operations will be accomplished is presented in Part III of the Assembly and Operations Plan RA-3, 4, & 5 EPD - 21. This FIM presents specific instructions for the RA-5 JPL/AMR field operations and integrates the officially applicable final instructions. This FIM relates all JPL Ranger Project documents considered official and obligatory upon JPL personnel cognizant for the JPL/AMR operations. For the proper continuity of the final RA-5 plan of operations, the FIM and the AOP must be conjoined and the instructional content of those JPL Ranger Project documents listed in paragraph E following must be employed.

B. Purpose

It is intended that the FIM accomplish the following:

1) Integrate those instructions contained in the applicable Ranger Project documents which are pertinent to the JPL/AMR Ranger Field Operations.

2) Provide the formal channel by which the final Ranger field operations instructions are officially transmitted to the JPL personnel. The FIM is binding upon JPL personnel exclusively. Updating of these instructions will be accomplished by issuing FIM revisions as required.

3) Supply the principal JPL inputs to the Flight Test Directive (FTD) LMSC No. 271674.

C. Scope

Basically the scope of the FIM is limited to JPL/AMR field operations and commences with the arrival of the flight articles at AMR and concludes with spacecraft injection. However, portions of the overall operations necessary to integrate the complete mission with the launch operations are included. The technical scope of the FIM is limited to a single mission involving the Ranger Spacecraft. FIM information will be restricted to detailed instructions not contained in the other referenced documents with the following exceptions:

1) Updated information which may not be available in time to be included in the planned revisions of the applicable JPL Ranger Project documents.

2) Repetition of information required to achieve a coherent and accurate FIM.

D. Operational Responsibility

Figure 1 shows the JPL/AMR Ranger A-5 Organization and Figure 2 identifies individuals who comprise the JPL Ranger A-5 Test Direction Team and Operations Support Groups and their areas of responsibility. This team will direct and accomplish the preparatory operations with the support of cognizant division engineers assigned to the individual subsystem groups. The Test Direction Team is the cognizant group for all JPL Ranger AMR Operations associated with the spacecraft. Figure 3 shows the functional relationship of the Test Direction Team in the Ranger A-5 Launch and Space Flight Organization. The Lunar Capsule Field Operations basic crew is shown in Figure 4. During the combined Ranger operations, the JPL Test Director functions as part of the launch organization.

E. Summary of Applicable Documents

The documents listed below are the official instructional sources in the respective areas of their scope and are listed in the order of their chronological contribution to the information and instruction required to accomplish the JPL/AMR RA-5 operations. All JPL documents listed are unclassified unless otherwise noted and will be maintained in a current condition as required.

1. Documents Issued by JPL

a. Assembly and Operation Plan (AOP) EPD - 21

The JPL/AMR operations by which RA-5 will be prepared, tested, and launched are presented in the Ranger AOP RA-3,4, & 5. However, the sequence of RA-5 AMR Operations has been changed because of experience gained in past operations on RA-3 & 4. For a clear conception of the revised sequence, refer to Figures 5 & 6. All formal JPL prelaunch, launch, and ground post launch activities are included and defined to the level of their objectives. JPL/AMR facilities, communications, and data acquisition equipment are identified, described, and integrated in this operations plan.

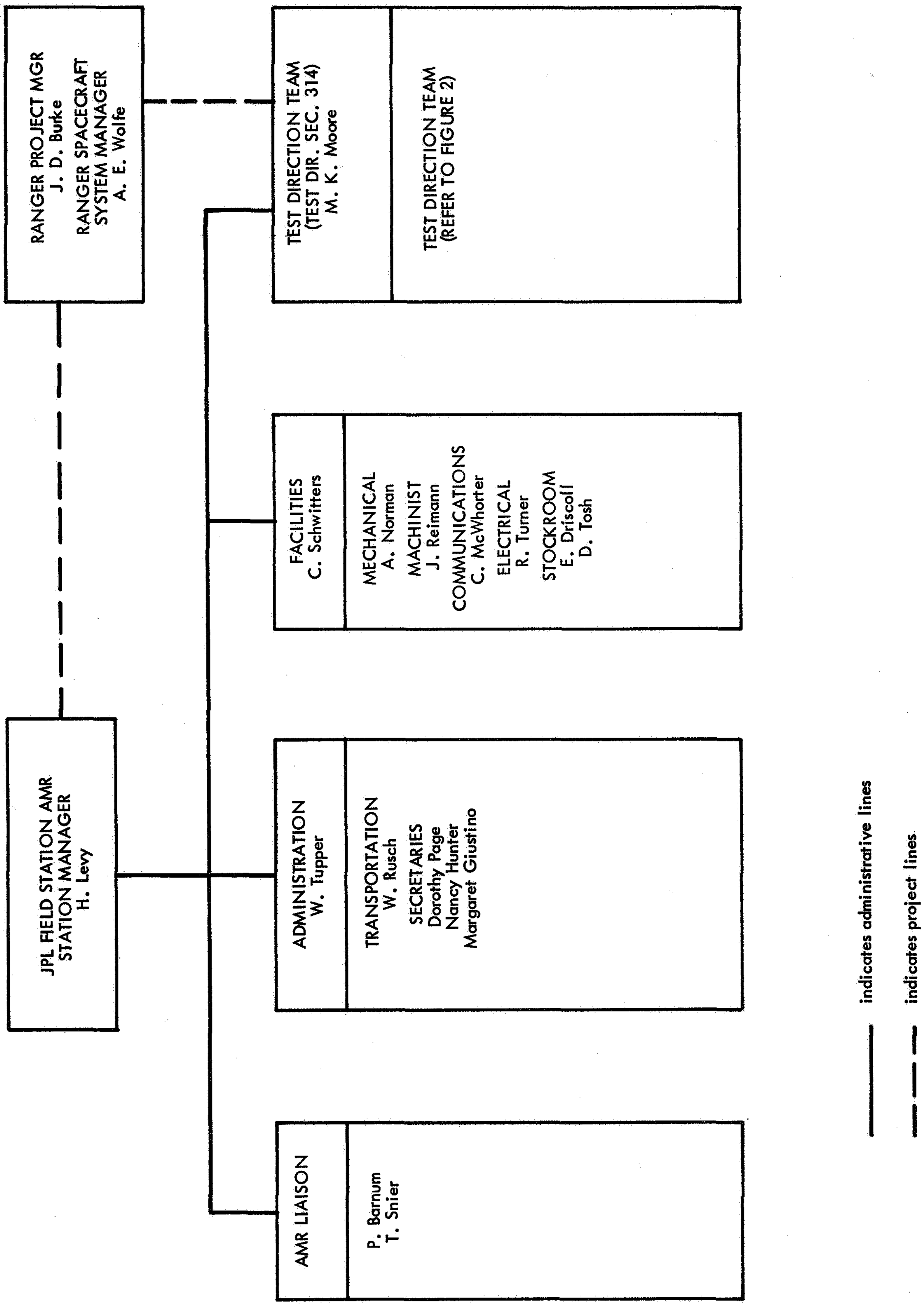


FIGURE 1. JPL/AMR RANGER A-5 ORGANIZATION

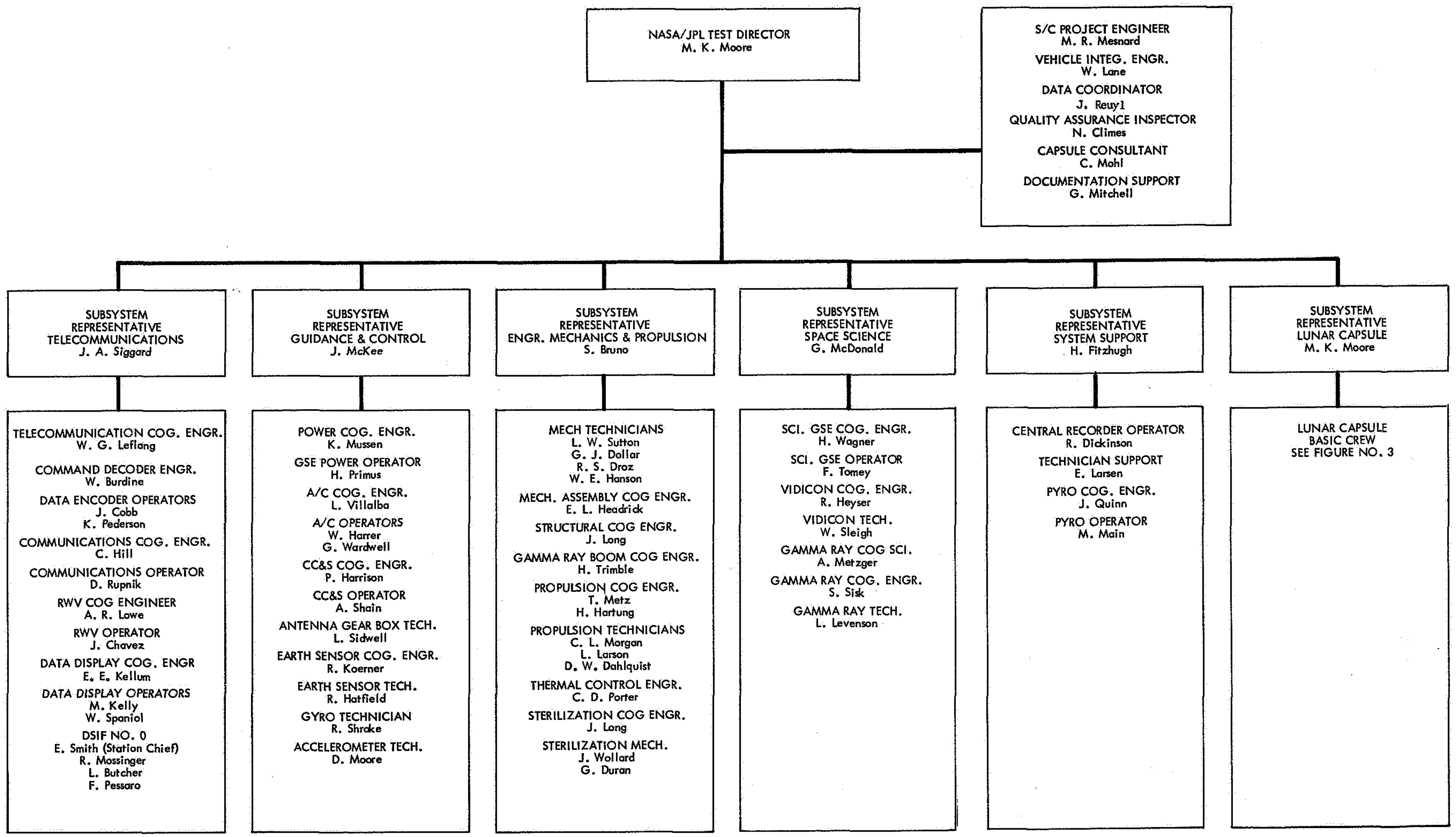


FIGURE 2. RANGER A-5 TEST DIRECTION TEAM AND SUPPORTING PERSONNEL

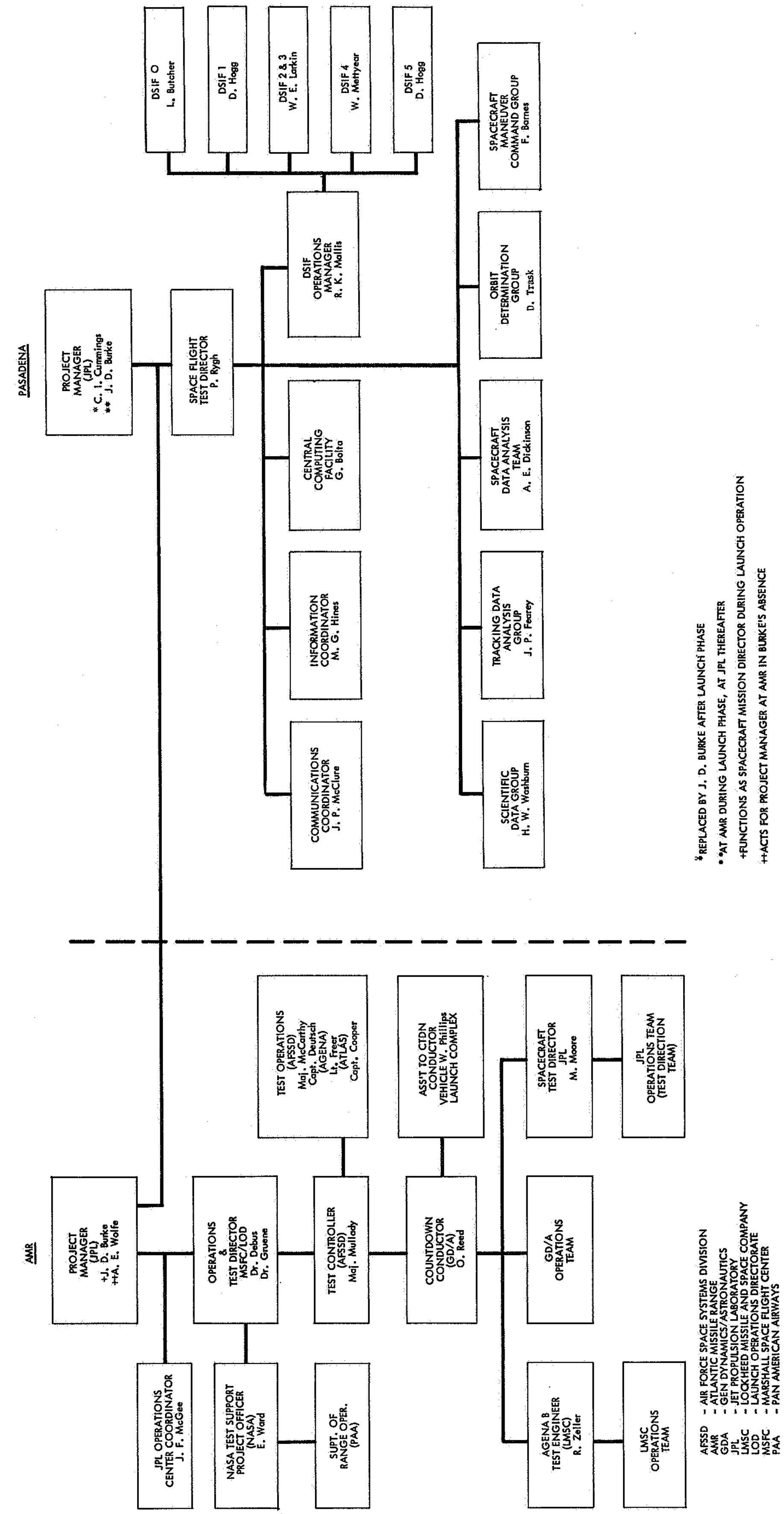


FIGURE 3. RANGER LAUNCH AND SPACE FLIGHT ORGANIZATION

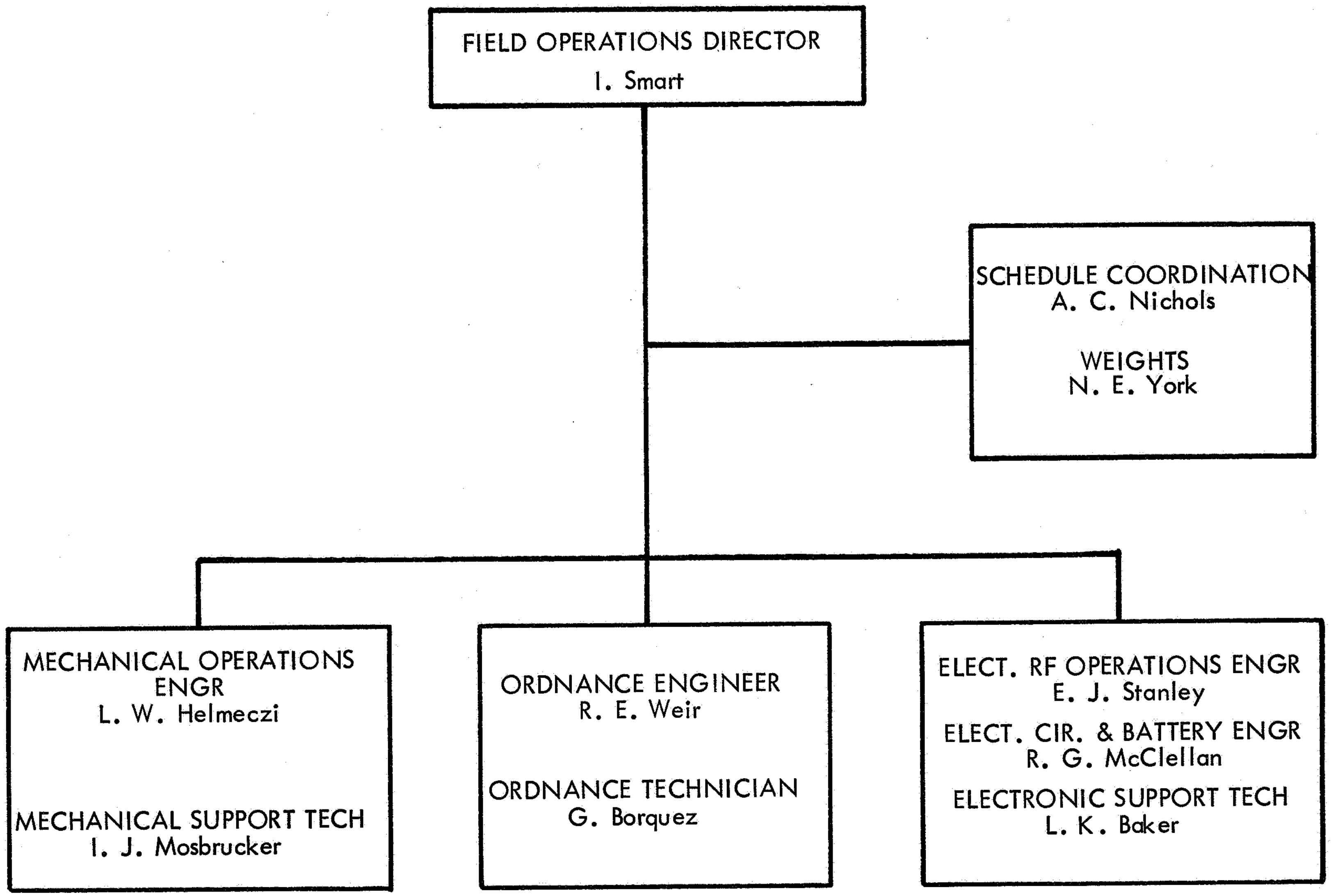


Figure 4. LUNAR CAPSULE RA - 5, FIELD OPERATION CREW

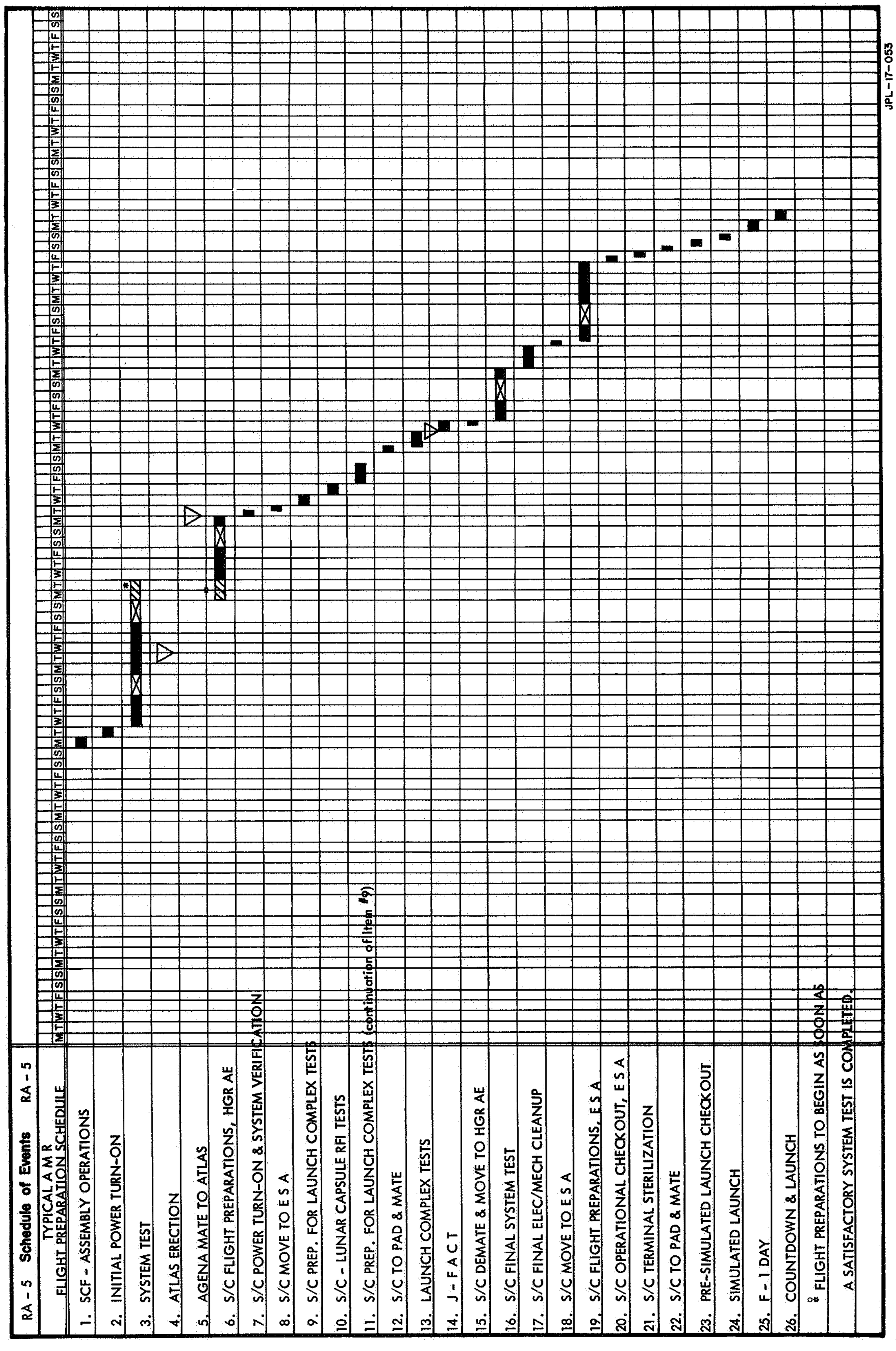


FIGURE 5. RA-5 AMR FLIGHT PREPARATION SCHEDULE, (TYPICAL)

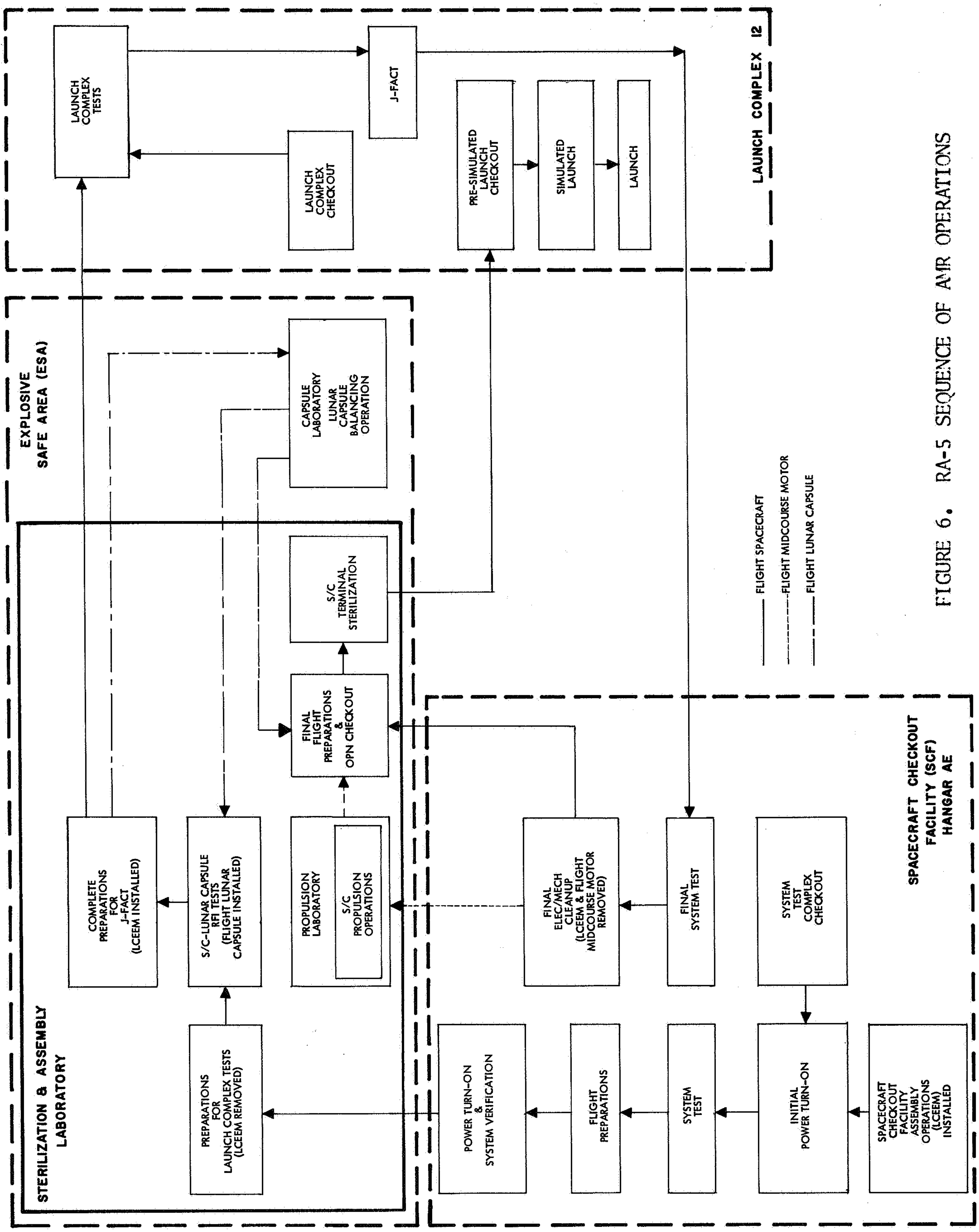


FIGURE 6. RA-5 SEQUENCE OF AMR OPERATIONS

b. Schedules

Weekly schedules of the JPL/AMR spacecraft operations will be published at AMR by the JPL Spacecraft Test Director. A typical schedule showing the elapsed time and phasing of the launch vehicle and spacecraft operations is shown in Figure 5.

c. Procedures

1) Standard Operating Procedures

Mission	Procedure No.	Title
P36R	100	Jet Vane Control System Alignment on Midcourse Propulsion Unit
P36R	101	Wt. CG, & Inertia
P36R	103	Belleville Springs
P36R	104	Alignment of Earth Sensor Mounting Surface
P36R	105	Mid-course Motor to S/C Alignment
P36R	106	High-Gain Antenna, Left-Hand Yoke Fitting Installation
P36R	107	Midcourse Propulsion Unit, Sterilization and Propellant Fill
P36R	108	Mid-course Propulsion Unit Detailed Assembly
P36R	111	Assembly of Altimeter and Retrosupport Structure on the Spacecraft
P36R	112	Pre-launch Monitoring Operations (Mid-course Propulsion System).
P36R	113	Installation and Alignment of the Omni Antenna Boom Assembly to the S/C
P36R	115	Weight and CG Control
P36R	117	Installation and Adjustment of Separation Sensor Assembly
P36R	118	Midcourse Propulsion System Leak Check and Propellant Fill

Mission	Procedure No.	Title
P36R	150	Assembly of Gamma-Ray Boom and Cable Dispenser
P36R	151	Mechanical Installation and Adjustment of Vidicon Telescope, Sun Shield, and Pin-puller
P36R	152	Vidicon Thermal Shield Installation
P36R	200	Initial Power Application and Subsystem Checks
P36R	201	Read, Write, & Verify (RWV)
P36R	202	Central Recorder Calibrations
P36R	203	CC&S Subsystem Checkout
P36R	204	Data Encoder Subsystem Checkout
P36R	205	Data Display Subsystem Checkout
P36R	206	Command Subsystem Checkout
P36R	207	RF Communications Subsystem Checkout
P36R	208	Attitude Control Subsystem Checkout
P36R	210	Pyrotechnics Subsystem Checkout
P36R	212	Central Recorder Standard Operations
P36R	213	RWV Checkout at DSIF
P36R	214	Data Display and Central Recorder Calibration
P36R	215	Spacecraft Power Survey
P36R	216	RF Attenuation Measurement from Launch Complex RF Trailer to Launch Pad
P36R	217	Squib Firing Assembly Final Preflight Evaluation

Mission	Procedures No.	Title
P36R	218	Phase locking RWV Receiver and Emergency Operation of Data Scanner and Modulator
P36R	219	Attitude Control Gas Pressurization of S/C
P36R	220	Preparation and Execution of Final Sterilization
P36R	221	Launch Complex #12 Umbilical Safe Checks
P36R	222	Preparation and Execution of Gear Box Sterilization
P36R	223	Preparation and Execution of Gamma-Ray Boom Sterilization
P36R	237	Pre-Load Determination of Ranger Spacecraft Feet to Agena Adapter
P36R	250	Scientific Instruments, Gamma-Ray Subsystem Checkout
P36R	251	Scientific Instruments, Vidicon Subsystem Checkout
P36R	300	System Test
P36R	301	Ground and Wiring Integrity
P36R	302	Spacecraft Environmental Simulator Test Plan
P36R	303	Dummy Run/Precountdown (Pasadena)
P36R	307	Atlas/Agena B J-FACT (JPL Portion)
P36R	308	AMR Countdown
P36R	309	AMR Precountdown
P36R	310	Launch Complex 12 Electrical Checkout
P36R	311	Vibration Environmental Test
P36R	312	Dummy Run Countdown (Pasadena)

Mission	Procedure No.	Title
P36R	313	Extension System Verification with Live Pyrotechnics
P36R	315	Final Assembly and Pre-flight Preparation
P36R	316	Final Button Up of Spacecraft at AMR
P36R	317	Operational Checkout of Spacecraft in the Explosive Safe Area
P36R	325	Altimeter calibration of D/E
P36R	326	Measurement of S/C RF looses in Launch Configuration
P36R	327	S/C Simulator Checkout
P36R	328	Lunar Capsule S/C RF Interference Test
P36R	329	High Gain Antenna Nesting and Final Scientific Power Checks

2) Emergency Shutdown Procedure (See Procedure 312)

3) JPL Countdown Procedure (See Procedures 303, 308, 309, 312)

4) Alternate Countdown Procedure (See RA-5 SFOP, Section V EPD - 77)

d. Telemetry Channel Assignment

Functional Specification RA-345 Appendix IV Revision B of the Spacecraft Designs Specification (SDS) Ranger A-5, assigns telemetry channels. Refer to Table 1 for current telemetry channel assignments with the primary measurements indicated with a letter "P".

e. Trajectory Reports

The standard trajectories for RA-5 will be published as EPD - 105 and will contain the pre- and post- injection standard trajectories for the RA-5 mission.

f. Space Flight Operations Plan (SFOP) Ranger RA-5, EPD - 77

The Space Flight Operations Plan defines the method by which the space flight operations will be conducted in both the standard case and anticipated departures from the standard case. Space flight operations are defined to be the operations necessary for the obtaining and processing of spacecraft information and commands required by JPL during the portion of flight from launch to the accomplishment of the mission. The operational facilities and support equipment are described, and the flow of data between facilities is outlined to show the operations scheduled to complete the mission. The required instructions and procedures are specified for operating sequences, orbit determination and direction of data flow.

g. Tracking Information Memorandum (TIM) Ranger A-5 (EPD - 111)

This document contains the detailed instructions to the DSIF stations directing their participation and defining their responsibilities in the mission. The TIM is bounded in scope by the SFOP but is expanded in detail to the level of instruction required to accomplish the tracking, data acquisition and data reporting as planned in the SFOP.

h. JPL Specification 30331D revised, Vehicle System Integration Requirements and Restraints for Ranger Spacecraft RA-1 through RA-5

This document contains the interface actions necessary to resolve the technical requirements and contraints imposed by the Spacecraft upon the Atlas/Agena vehicle.

2. Documents Issued by Other Agencies

The following documents, through not considered part of the FIM, are included to show complete Ranger A-5 documentation.

a. Ranger Program Requirements Document (PRD) No. 1800 (Confidential)

b. Ranger Program Support Plan No. 1800

c. Operational Requirements (OR). (1800 Series)

d. Ranger System Operation Plan (SOP) LMSC No. 376493-A (Confidential)

e. Ranger System Test Opjective LMSC A047504 (Confidential)

f. Flight Test Directive (FTD) LMSC No. 271674

g. Countdown Manual, LMSC No. 133084 (NASA Lunar Missions AMR - Spacecraft-Agena B/Atlas.)

h. Range Safety Trajectory & Analysis Report LMSC No. A071036

i. Consolidated Insturmentation Plan Ranger Vehicle RA-4 MTP-LOD-62-9.1 (Confidential)

j. General Range Safety Plan (AFMTC)

(1) Vol. I, Missile Handling

(2) Vol. II, Launch Operations

k. Danger Area Information Plan (AFMTC)

F. Special Information

1. Interface Operations Responsibility

LMSC will be cognizant and responsible for the performance of interface operations involving the spacecraft adapter and shroud. JPL personnel will monitor all interface activities involving the Ranger spacecraft. Ranger spacecraft interface operations excluding launch complex operations will take place in JPL facilities. The following definitions of areas of responsibility have been agreed upon by JPL and LMSC.

Operation	Responsibility
(a) Match-mate Test in the Explosive Safe Facility	LMSC
(b) Mating and demating of the spacecraft to the spacecraft adapter and shroud	LMSC

(c) Transportation of the mated spacecraft-adapter-shroud assembly between Hangar "AE" Explosive Safe Area, and the base of the Launch Comple Gantry No. 12	JPL
(d) Transportation of the space-craft-adapter-shroud assembly between the base of the gantry and the top of the Agena B and the mating or demating to Agena B	LMSC

Due to handling problems and time consumed in mating and demating of the Ranger Spacecraft with the spacecraft adapter and shroud, the number of such interface operations should be kept to a minimum.

2. Spacecraft Malfunction

In the event of a spacecraft malfunction, the spacecraft will be removed from the gantry and returned to the ESA for removal of all pyrotechnics before any required maintenance. Removal to Hangar AE for any servicing will depend on the extent of the malfunction. An abbreviated system test (in Hangar Functional Checkout) must be performed on the spacecraft following any component repair or replacement. For spacecraft turn-around time estimate, refer to Figure 7.

Depending upon the nature of any malfunction of the midcourse motor or retromotor, the disassembly, removal, and reassembly time required will nominally be 24 hours The midcourse and retromotor along with all squibs will be removed from the Spacecraft in the ESA before being taken to Hangar AE for servicing. Those operations involved will be:

1) Lowering of pneumatic pressure

2) Removing squibs

3) Removing the retro-motor

4) Removing the midcourse motor

5) De-fueling, the midcourse motor

6) Re-fueling, re-installing motors and squibs

7) Pressurizing

II. LAUNCH INFORMATION

The combined agency countdown will be conducted in accordance with the RANGER LOCKHEED/GENERAL DYNAMICS/JPL COUNTDOWN (AGENA B/ATLAS/RANGER A-5, respectively) RA-5 COUNTDOWN MANUAL (LMSC No. 133084) The JPL portion of the integrated countdown is given in JPL Procedure P36R 308, copies of which are available through the JPL Test Director or the Spacecraft Countdown Conductor.

III. LAUNCH AND HOLD CRITERIA

A. General

The launch and hold criteria are intended to establish in advance a basis for quick trade-off decisions on a course of action in the event of foreseeable failures or difficulties during the RA-5 Spacecraft final preparation and countdown. These criteria are based upon the concept of the primary and secondary objectives. Interference with a primary objective is cause for a hold or launch concellation independent of the time of occurrence, whereas interference with a secondary objective may or may not be a sufficient cause, depending upon the time of occurrence.

The following are considered as primary objectives (See Design Specification RA-345-2-110D)

Primary Objectives

1) Tracking and trajectory determination in real time.

2) Spacecraft separation devices and separation monitors.

3) Proper functioning of the following subsystems:

   a) Power

   b) Attitude Control

   c) Central Computer & Sequencer

   d) Temperature control

   e) Structures

   f) Telecommunication and on-board data processing

   g) Scientific instrumentation

   h) Mid-course propulsion

   i) Lunar Capsule

The proper functioning of all other subsystems (capsule) is then secondary in the sense that there is some combination of circumstances under which a launch would not be postponed because of a known malfunctioning of a subsystem. The following paragraphs give the criteria to be followed as a function of time to launch.

B. Spacecraft in SCF

During the period when the spacecraft is in the SCF, primary and secondary objectives will be treated in an equal manner. Every attempt will be made to correct any deficiences, primary or secondary.

C. Requirements for Transportation to the Launch Complex

The decision for going to the launch pad complex will be based upon both primary and secondary subsystems functioning properly. If a subsystem affecting primary objectives is malfunctioning, the spacecraft will be held until the difficulty has been corrected. If a secondary subsystem is malfunctioning the spacecraft may be held in the SCF for 48 hours. If the difficulty is not corrected within this time, the move to the pad will be made at the discretion of the Spacecraft System Manager. If the trouble is such that the additional few days will not help, then the Spacecraft System Manager or his authorized representative may elect to proceed with launch activities immediately.

D. Pad Operations

1. Countdown HOLD Criteria

The possible compromise of any of the primary objectives (Ref. para. III-A) shall be cause for a HOLD. The procedure shall be to call a HOLD (if late in the count) to permit evaluation of the malfunction. Ground equipment malfunctions that can be repaired during the countdown will make a HOLD necessary rather than require a launch postponement.

Primary telemetry measurements are indicated in Table 1 by the letter "P". The primary measurements are those necessary to properly evaluate the Spacecraft to achieve the primary mission objectives. Achievement of the primary mission objectives will be jeopardized if the Spacecraft is launched with any of the primary measurements missing. Therefore loss of a primary measurment is cause for a HOLD. The final decision to launch with the loss of any any telemetry measurement is made by the Project Manager.

2. Launch Periods

The launch period totals four consecutive days in which a launch window exists for each day of the four days. If launch is not accomplished during that interval, the next available period will be a month later. Information regarding the alternate launch periods is given in the Design Specification, Ranger A-5 Trajectory, Lunar Impact Criteria, JPL Spec. No. 30238 (Confidential).

3. Spacecraft Turn-Around Time

Should the spacecraft have to be removed during the countdown, the minimum times for removal, preparations for repair, and remate with the Agena are defined in JPL Mechanical Assembly Checksheet (No. 109) and JPL Procedure No. 315, 316 and 317.

Figure 7 shows the present best estimate of times and necessary steps required to resolve a spacecraft malfunction while on the launch pad. Referring to Figure 7, it can be seen there are two malfunction routes the spacecraft can follow. In malfunction condition I, the longest replacement/repair time estimate is 37.75 hours, excluding problem resolution time. In malfunction condition II, the longest replacement/repair time estimate is 48 hours excluding problem resolution time.

A "Spares Replacement Log" is kept by the Quality Control Group to show the dependent conditions upon which the interchange of units on RA-5 can be made. It indicates for each module whether or not recalibration is necessary and also gives the approximate total replacement time for each module.

E. Space Flight Operational Requirements

1. Mandatory Tracking Stations.

a) Antigua, Ruerto Rico, or San Salvador in that order.

b) Range Ship, or Pretoria,(DEPENDING ON SHIPS POSITION AND LAUNCH AZIMUTH)

c) DSIF No. 1 (FOR SOME LAUNCH AZIMUTHS)

d) DSIF No. 4

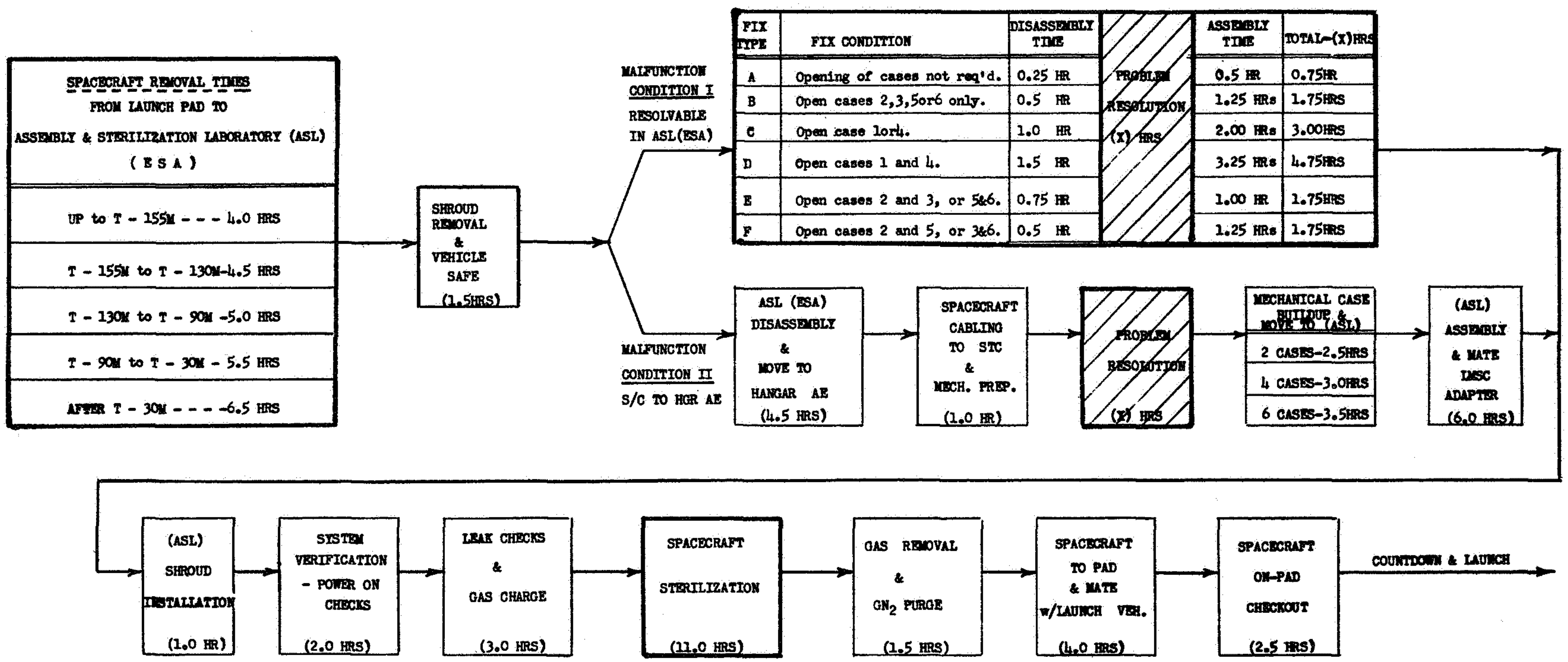


Figure 7. SPACECRAFT TURN-AROUND TIME.

2. Mandatory Communications Lines.

   a) TTY line from AMR to JPL/SFOC.

   b) TTY line from JPL/SFOC to DSIF No. 1 for some launch azimuths.

   c) TTY line from JPL/SFOC to DSIF No. 4

   d) AMR to one of (1-a) above.

3. Telemetry Requirements

   See Table 1 for RA-5 Telemetering Channel Assignments. The telemetry measurements listed in Table 1 are desig - nated "P" when considered primary. Those not so desig - nated are Secondary measurements. The loss of an indi - vidual Secondary measurement will not jeopardize achievement of the primary mission objectives. However, under some conditions loss of a combination of Secondary Measurements could affect achievement of highly desirable mission objectives and could cause a launch delay.

4. Telecommunications Launch Criteria

   *a) Telemetry Measurements

1)	Lo Gain antenna drive	4E0
2)	Hi Gain antenna drive	4E1
3)	Receiver AGC (coarse or fine)	3D0 or 4E3
4)	Receiver phase error (coarse or fine	3D2 or 4E5
5)	400 cps frequency	1
6)	Commutator sync	B-19

   b) Required Telemetry and Communications GSE for S/C Evaluation

      1) DSIF No. 0, Trailer during Spacecraft checkout.

      2) RWV during spacecraft checkout.

      3) Data Encoder Blockhouse GSE or Hanger AE Data Encoder GSE and hard line mixed tones.

*NOTE: TELECOMMUNICATIONS CHANNEL CRITERIA SHOWN ABOVE ARE ALSO CONTAINED IN TABLE 1.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	DATA ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
P	5-A-2	Yaw Gyro Torque	±0.4°/Sec	±5.8v dc	15%*	0.2
P	5-A-3	Roll Gyro Torque	±0.4°/Sec	±5.8v dc	15%*	0.2
P	5-A-4	Pitch Gyro Torque	±0.4°/Sec	±5.8v dc	15%*	0.2
P	2-C-0	Roll Position (Earth Sensor)	±2.5°	±20v dc	5%	10
2 P	2-C-1	Hinge Earth Sensor Out	±2.5°	±20v dc	5%	10
P	2-C-8	Earth Sensor Light Intensity	0.01 to 17 Ft-Candles	0 to -0.5v dc	5%	10
P	2-C-5	Pitch Rate Gyro (Fine)	±62°/HR	±0.83v dc	5%	10
P	2-C-6	Yaw Rate Gyro (Fine)	±62°/HR	±0.83v dc	5%	10
P	2-C-7	Roll Rate Gyro (Fine)	±62°/HR	±0.83v dc	5%	10
	2-C-2	Pitch Switching Amplifier Output	POLARITY	0 ± 12.5v dc	5%	10
	2-C-3	Yaw Switching Amplifier Output	POLARITY	0 ± 12.5v dc	5%	10
P	6-B-0	+Y Yaw Jet Vane Angle	±25°	±13.3v dc	15%*	0.2
P	6-B-1	-Y Yaw Jet Vane Angle	±25°	±13.3v dc	15%*	0.2

* Due to Noise Error at Threshold

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D).

		CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	DATA ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
	P	6-B-2	+X Pitch Jet Vane Angle	±25°	±13.3v dc	15%*	0.2
	P	6-B-3	-X Pitch Jet Vane Angle	±25°	±13.3v dc	15%*	0.2
1	P	2-C-4	Yaw Rate Gyro (Coarse)	±1500°/HR	±20v dc	5%	10
1	P	3-D-1	Pitch Rate Gyro (Coarse)	±1500°/HR	±20v dc	5%	10
1	P	3-D-3	Pitch Sun Sensor Out	±0.9°	±18v dc	5%	10
1	P	3-D-4	Yaw Sun Sensor Out	±0.9°	±18v dc	5%	10
	P	3-D-6	Antenna Hinge Angle	0 to 180°	+0.33 to +5.33v dc	5%	10
	P	3-D-7	Roll Rate Gyro (Coarse)	±1500°/HR	±20v dc	5%	10
	P	3-F-8	A/C Nitrogen Tank Pressure	0 to 3500 psia	±6v dc	5%	100
	P	2-G-5	A/C Nitrogen Tank Temperature	-25°F to +165°F	±0.125v dc	5%	100
	P	1	400 C.P.S.	400 ± 1 cps	6 v Pulses 400 ± 1 pps		Cont.
		B-2-1	CC & S Program	Event	+6 v pulse	3 sec.	Cont.
	P	B-20	Mid-course Velocity Increment	0 to 204.7 Ft/Sec 12 bits	-6 v Pulse		1 Word every 8 sec.
	P	8	Mid-course Acceleration	0 to 2.4 Ft/Sec^2	0 to 25 pps +5 v Pulse		Cont.

* Due to Noise Error at Threshold

P=Primary measurement for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

		CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
	P	3-D-8	Power System Voltage	+18 to +31v dc	0 to 5v dc	5%	10
1	P	4-E-6	+X Panel (4A9) Amperes	0 to 5 amps	0 to 5v dc	5%	100
	P	4-E-7	-X Panel (4A10) Amperes	0 to 5 amps	0 to 5v dc	5%	100
1	P	3-F-0	-X Panel (4A10) Volts	20 to 35vdc	20 to 35v dc	5%	100
	P	3-F-1	+X Panel (4A9) Volts	20 to 35vdc	20 to 35v dc	5%	100
		3-F-2	Power Converter A/C (4A3) Volts	0 to 4.5vdc	0 to 5v dc	5%	100
		3-F-3	Power Inverter CC&S (4A6) Volts	0 to 4.5vdc	0 to 5v dc	5%	100
		3-F-4	Power Converter Command(4A5) volts	0 to 4.5vdc	0 to 5v dc	5%	100
		3-F-5	Power Inverter Scientific(4A8) v	0 to 4.5vdc	0 to 5v dc	5%	100
	P	3-F-7	Power System Current	0 to 10 amps	0 to 5v dc	5%	100
1	P	2-G-0	+X Panel (4A9) Front Temp.	+45°F to +145°F	±0.125v dc	5%	100
	P	2-G-1	+X Panel (4A9) Back Temp.	+45°F to +145°F	±0.125v dc	5%	100

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraph 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. JPL TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
1 P	2-G-2	-X Panel (4A10) Front Temp.	+45°F to +145°F	±0.125v dc	5%	100
P	2-G-3	-X Panel (4A10) Back Temp.	+45°F to +145°F	±0.125v dc	5%	100
	2-G-8	Solar Panel Extension	Event	6 v Step	5%	100
1 P	4-H-0	Power Boost Reg. (4A2) Temp.	0 to 200°F	0 to +0.5vdc	5%	1000
P	4-H-4	Power 400 cps 1 Phase Inverter (4A13) Volts	0 to 4.5vdc	0 to +5v dc	5%	1000
	4-H-5	Power 400 cps 3 Phase Inverter (4A14 volts)	0 to 4.5vdc	0 to 5v dc	5%	1000
	4-H-6	Solar Cell Short Circuit Amperes	0 to 0.2 amps	0 to +0.5vdc	5%	1000
	4-H-7	Solar Cell Open Circuit Voltage	0 to 0.25vdc	0 to +0.5vdc	5%	1000
P	4-J-4	Battery Temperature	+32 to +158°F	0 to -0.2vdc	5%	1000
	4-J-6	Power Switching & Logic Temp.	0 to 200°F	0 to -0.2vdc	5%	1000
	B-2-2	Squib Fire Tele	Event	+6 v Pulse	3 Sec	CONT.
	B-2-3	Omni Antenna Extension	Event	+6 v Pulse	3 Sec	CONT.
	B-2-4	Radio Altimeter Extension	Event	+4.5 v Pulse	3 Sec	CONT.

P=Primary measurement for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5. for specific Telecommunication and temperature criteria

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
	B-2-4	Capsule Separation	Event	+4.5 v Pulse	3 Sec	CONT.
	3-F-6	Tele Mode Indication	Modes I-III	±0.5v dc	5%	100
	2-G-4	Gyro Pkg. Temp.	0 to 70°C	±0.125v dc	5%	100
	2-G-6	Temp. Control Temp.	-25°F to +165°F	±0.125v dc	5%	100
	6-B-4	Calibration - High		+1.0 v dc	15%*	0.2
	2-G-7	Calibration - Mid, Temp. Br.		562 ohms	5%	100
	3-F-9	Calibration - Mid		0 v dc	5%	100
	4-J-8	Calibration - High Temp. Br.		562 ohms	5%	1000
P	5-A-0	Helium Tank Pressure	0 to 3600 psia	±6v dc	15%*	0.2
P	5-A-1	Fuel Tank Pressure	0 to 460 psia	±6v dc	15%	0.2
	4-H-8	M/C Nitrogen Tank Pressure	0 to 3600 psia	±6v dc	5%	1000
	4-H-9	Fuel Tank Pressure	0 to 460 psia	±6 v dc	5%	1000

* Due to Noise Error at Threshold

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraph 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
	2-D-0	"D" Bridge Reference Frequency	Mid Band	562 ohms	5%	10
	2-D-2	"	"	"	5%	10
	2-D-3	"	"	"	5%	10
	2-D-4	"	"	"	5%	10
	2-D-6	"	"	"	5%	10
	2-D-7	"	"	"	5%	10
	2-D-8	"	"	"	5%	10
	2-D-9	"	"	"	5%	10
P	2-D-1	-Y Yaw Jet Vane Actuator Temp.	0 to +500°F	±0.25v dc	5%	10
P	2-D-5	Fuel Tank Temp.	-25°F to +165°F	±0.25v dc	5%	10
	3-D-0	Receiver AGC (Coarse)	-50 to -140 dbm	-2 to +5.5 v dc	5%	10
	3-D-5	Receiver AGC (Coarse)	-50 to -140 dbm	-2 to +5.5 v dc	5%	10

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	DATA ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
P	3-D-2	Receiver Phase Error (Coarse)	±3.75v dc	±1.5v dc	5%	10
P	4-E-0	Lo Gain Antenna Drive	+10 to +35 dbm	0 to+0.5vdc	5%	100
P	4-E-1	High Gain Antenna Drive	+10 to +35 dbm	0 to+0.5vdc	5%	100
	4-E-2	Transponder R.F. Drive Level	0 to +10 dbm	0 to+0.5vdc	5%	100
P	4-E-3	Receiver AGC (Fine)	-100 to -140 dbm	+2 to +4.5 v dc	5%	100
	4-E-4	Transponder High Voltage Supply	0 to +250 v dc	0 to +0.5 v dc	5%	100
	4-E-5	Receiver Phase Error (Fine)	0 to -2v dc	0 to -0.5 v dc	5%	100
	4-H-3	Receiver Mixer Current	-3 to +3 dbm	0 to -0.1 v dc	5%	1000
P	4-J-3	Transponder Temperature	+14 to +158° F	0 to -0.2 v dc	5%	1000
	B-20	Command System Output	17 Bits	0 or -6v dc		CONT.
P	B-19	Commutator Sync				CONT.
	2-G-9	Gamma Ray Boom Extension	Event	6 v Step	5%	100

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5 for specific Telecommunication and temperature criteria.

TABLE 1. RA-5 TELEMETERING CHANNEL ASSIGNMENT (CONT'D)

	CHANNEL	MEASUREMENTS	MEASUREMENT RANGE	DATA ENCODER INPUT RANGE	COMBINED ACCURACY OF DATA ENCODER & DATA REDUCTION	SAMPLE RATE SEC/SAMPLE
P	8	Gamma Ray Intensity	25 Bits/sec 512 Bits/ word	±2.5 v		1 word every 8 min.
P	V	Gamma Ray Intensity	200 Bits/s 512 Bits/ word	±2.5 v		1 word every 52 sec
P	V	Vidicon Output	0 to 2 kc	0 to -2 v		1 Frame every 13 sec
	V	Altimeter Echo Strength	-60dbm to -100dbm	±2.5 v	10%	13 Sec.
P	4-J-0	Earth Sensor Temperature	±100°F	0 to -0.2 v dc	5%	1000
P	4-J-1	+Y Pitch (7A13) S Sun Sensor Temp.	+14° to 140° F	0 to -0.2 v dc	5%	1000
P	4-J-2	-Y Pitch (7A11) Sun Sensor Temp.	+14° to 140° F	0 to -0.2 v dc	5%	1000
2 P	4-J-9	Differential (7A10 Minus 7A12) Sun Sensor Temp.	±36°F in -31 to +95°F	0 to -0.2 v dc	5%	1000
P	4-H-1	Power Converter A/C (4A3) Temp.	0 to 200°F	0 to +0.5 v dc	5%	1000
P	4-H-2	+Yaw Jet Vane Actuator Temp.	0°F to +500° F	0 to +0.5 v dc	5%	1000
P	4-J-5	M/C Nitrogen Tank Temp.	-25°F to +165°F	0 to -0.2 v dc	5%	1000
P	4-J-7	Gamma Ray Experiments Temperature	+32 to +104° F	0 to -0.2 v dc	5%	1000

P=Primary measurements for Launch. Minimums for a group are indicated by bracket with Number. Refer to paragraphs 4 and 5 for specific Telecommunication and temperature criteria.

4) Blockhouse Data Display or Hangar AE Data Display and hard line mixed tones.

c) Transponder Signal Level Requirements

1) Less than 4 db variation of transponder power output via high gain antenna.

2) Less than 4 db variation of transponder power output via low gain antenna with either gantry in place or removed.

5. <u>Temperature Telemetry Requirements</u>

Transponder Temp.	4J3		Primary Measurement
Gyro Temp.	2G4		
Boost Regulator	4H0		
Battery	4J4		Primary Measurement
Power Switching & Logic	4J6		
Solar Panel Temp.	2G0	1	Primary Measurement
Solar Panel Temp.	2G1		
Solar Panel Temp.	2G2	1	Primary Measurement
Solar Panel Temp.	2G3		
Earth Sensor	4J0	2	Primary Measurements
Sun Sensor	4J1		
Sun Sensor	4J2		
Sun Sensor Diff.			
A/C Pwr Conv.	4H1		
+Yaw Jet Vane	4H2		
Helium Tank	4J5		
Gamma Ray	4J7		
-Yaw Jet Vane Actuator Temp.	2D1		
Nitrogen Tank	2G5		Primary Measurement
Temp. Control	2G6		

F. RA-5 Scientific Subsystem Hold Criteria

The following criteria may be used as a guide:

1. All scientific experiments must be operating properly prior to transfer of Ranger A-5 to the launch pad.
2. The three scientific experiments gamma-ray, vidicon, camera, and capsule are equally weighted as far as mission importance.
3. If it is necessary to demate the spacecraft and return it to Hangar AE for test of any subsystem, the scientific subsystem must again be verified.
4. The failure of any one of the three scientific experiments is cause for a "HOLD".

G. Hold Procedure After T-2 Minutes

The CC&S inhibit switch will be released at T-2 M. In the event of a hold caused by other than the spacecraft between T-2 M and T-1 M, the CC&S will be reinhibited until the duration of the hold, and pickup time can be determined. The inhibit switch will be released when the countdown is resumed. Where possible, the CC&S will be recleared to allow for a more accurate determination of the clear, T-60 S, event. The relay hold switch will be released at T-1 M after the clear event has been observed.

Should a hold be called from T-1 M to launch, the CC&S will be allowed to keep running until the time of AGENA separation from the spacecraft is within 60-seconds of the solar panels unfold event. At this point, the CC&S will be inhibited, relay hold activated and cleared for a reset of time back to T-2 M.

IV. SAFETY CONSIDERATIONS

A. General

The range safety instruction contained in the documents listed in paragraph 2-j & k of section I-E will be observed. Additionally, the safety instructions listed below will be observed.

B. Pyrotechnics

The spacecraft pyrotechnic devices can be grouped into a number of categories, such as: (1) pin pullers, (2) midcourse motor valve squibs, (3) bolt cutters, (4) initiators. Although special handling procedures may apply, in part, to each individual group, the following general safety precautions should prevail in the handling of all pyrotechnic devices:

1. During all operations with live pyrotechnics, the number of personnel required in the immediate area shall be kept to the absolute minimum.

2. Until the devices are to be tested or installed, they should be stored in a safe container.

3. During installation or checkout on the spacecraft, all spacecraft power shall be turned off.

4. No operations involving pyrotechnic devices shall be performed if an electrical storm is within 10 miles of the area.

5. No operations involving pyrotechnics shall be performed if there are electrical circuits carrying 100 amperes, or more, within 10 feet of the operations. Such circuits should be turned off during the operations.

6. Continuity checks made through pyrotechnic devices, or through associated circuits, shall be performed with a low-current ohmmeter having a short-circuit-current capability of 10 milliampere, or less.

7. Before mating electrical cables to the pyrotechnic devices, a check shall be made to verify that no voltage exists on the cable.

8. Shorting plugs shall be maintained at - or as close as possible to the explosive devices until final electrical connections are made. The final connections shall be made at the latest possible time in the assembly operation.

9. Final mating of the squib harnesses to the squib firing assembly (SFA) shall be made only after a no-voltage check has been made at the SFA output. Additionally, it should be verified, prior to final mating, that the SFA is in the SAFE condition.

10. When a conflict arises as to sequence of operations involving assembly, continuity checks, and no-voltage checks, it shall be resolved with a consideration of the relative potential dangers of the devices involved.

C. Radiation Hazards

The only radiation in the Gamma-ray Spectrometer is far below the hazardous level of radiation.

D. Pressurized Vessels

1. Handling Procedure

All pressure vessels receives the same care with respect to storage and installation on the spacecraft. All flight vessels are stored in padded containers in a safe place until ready for installation. Only authorized personnel have access to these pressure vessels. Installation into the system is done only by authorized people and under the supervision of a designated individual. This individual is indoctrinated as to the safety requirements necessary and is held responsible to see that installation is done in an acceptable manner. Immediately after installation, all pressure vessels are protected by either foam plastic or a reinforced plastic shroud. Any damage to pressure vessels (nicks,etc) should be reported to the JPL Test Director inasmuch as factors of safety depend upon vessel integrity. Subsequent handling of the spacecraft is in accord with established safety regulations applicable to the safe handling of pressure vessels.

2. Pressurization and Checkout

During in-hangar checkouts, where the pressure vessels are pressurized in the vicinity of personnel, a reduced pressure is used in all cases. (This reduced pressure will be such that a margin of safety in excess of four will exist at all times.) The only time when full pressurization is required in the presence of personnel is at the time of pressurization, when lines are disconnected from the charging port, during final assembly operations at ESA, during transport from the ESA to the pad and during mating to the Agena.

3. Attitude Control Pressure Vessel Safety

The vessels are three titanium spheres six inches in diameter used to store nitrogen gas at 3600 psi for the attitude control system. These vessels are located beneath the spacecraft hexagonal bus.

The pressure vessels are enclosed by an aluminum heat shield. During systems checkouts at JPL-SAF, and at JPL-Hangar AE at AMR, checkout pressure is maintained below 1500 psi. Final checkouts at AMR prior to J-FACT and on-pad checks are made at full operating pressure, 3600 psi. No proof-testing pressure(5400 psi) is done after delivery to AMR. The final on-pad checkout can be made remotely. The pressurized vessel is transported to the Launch Complex at full prescribed operating pressure, 3600 psi.

4. Midcourse Motor Pressure Vessel Safety

The midcourse motor pressure vessel is composed of a spherical bottle (5-inch diameter) charged with helium, and is located under the motor mounting plate of the midcourse propulsion unit. The fuel tank vessel is an ellipsoidal bottle, containing a Butyl Bladder (N_2H_2) located above the motor. These vessels are protected by a soft plastic shroud. The Engineering Mechanics Subsystem Representative at AMR is supervising installation and handling.

V. JOINT SPACE FLIGHT AND LAUNCH OPERATIONS

A. General

Launch operations and data transmission will be in accord with the information presented in paragraphs B, C, D, E, F, and Figures 8 through 19. A complete system test of AMR data transmission nets will be performed. Definitions of the station identification symbols used herein are listed below.

Station	Location
A	JPL Space Flight Operations Center, Pasadena
B	JPL Communications Center, JPL, Pasadena
C	Central Computing Facility, Pasadena, (Bldg. 125)
D	Central Computing Facility, Pasadena, (Back Up for Sta. C Bldg. 202)
E	JPL Mission Operations Center, Hangar AE, AMR, Florida
IPP	Computer Facility at AMR
DSIF No. 0	Launch Tracking Station, AMR
DSIF No. 1	Mobile Tracking Stations (South Africa)
DSIF No. 2	Goldstone Pioneer Station
DSIF No. 3	Goldstone Echo Station
DSIF No. 4	Woomera, Australia
DSIF No. 5	Johannesburg, South Africa

The above symbols are extracted from the complete key given in the Ranger A-5, SFOP, EPD - 77.

B. Format of Information to be sent from A & C to E

1. Operational readiness report of:

Stations	Status of
C	-Communications, Computer
DSIF 1, 2, 3, 4, and 5	-Communications, Data and Tracking

If all stations are operational, message should read:

"CAPJET DE JETLAB (TIME GMT)
SPACE FLIGHT OPERATIONS READY"

If a not-ready condition exists, the message should indicate which station, type of difficulty and estimate of time for operational readiness.

These reports are transmitted to E at selected times during the countdown. (Ref. Ranger A-5, SFOP, EPD - 77)

2. Acquisition message by DSIF should contain:

"CAPJET DE JETLAB (TIME GMT)
(STATION, TIME OF LOCK, 1 OR 2-WAY LOCK)"

These reports are transmitted to E by voice and TTY immediately following acquisition by DSIF 1, 4, and 5.

3. Telemetry events report after data reduction should contain:

"CAPJET DE JETLAB (TIME GMT)"

(EVENT) (TIME)

This report is transmitted to E at approximately I + 95 minutes via voice and TTY.

NOTES:
a. All TTY heading times are GMT.
b. All Telemetry event times in minutes from injection.
c. All TTY reports will be transmitted on Raw Data TTY circuit.
d. All voice reports will be transmitted on GREEN voice net.

C. <u>Format of Information to be sent from E to A & C.</u>

1. Milestone events of Complex 12 countdown will be transmitted by voice on GREEN voice net.

2. Countdown clocks at JPL will be synchronized with the Cape by voice on the GREEN voice net.

3. (AMR) Tracking Status

Stations	Status of
IPP	Communications, Computer
Puerto Rico	Communications, Data, Radars
Antigua	Communications, Data, Radars
Ascension	Communications, Data, Radars
Tracking Ships	Communications, Data, Radars
Pretoria	Communications, Data, Radars

If all stations are operational, message should read:

"JETLAB DE CAPJET (TIME GMT)
AMR TRACKING READY

If a not-ready condition exists, message should indicate which station, type of difficulty and estimate of time for operational readiness.

This report is transmitted by E at selected times during the countdown. (Ref. RA-5, SFOP, EPD - 77)

4. RA-5 countdown information required by the Space Flight Operations and DSIF per SFOP, EPD - 77, and reported by the Mission Operations Center - AMR at the times indicated is as follows:

T-90 Minutes

(a) DSIF No. 0 (RF Trailer) reports to Telecommunications Representative and E on MOIS Channel 11 the following items and Zulu time of measurements.

(1) Transponder carrier frequency on auxiliary oscillator drive.

(2) Ground transmitter 890 mc frequency at zero SPE volts.

(3) Transponder 960 mc frequency at zero SPE volts.

(4) Case 2 temperature (Reading obtained by Telecommunications Representative).

(b) E Reports to SFO on GREEN voice line.

T-12 Minutes

Telecommunication Representative reports Zulu time of Rate 4 - 9 sync and to E on Channel 11.

T-10 Minutes E reports to SFO Zulu time of rate 4 - 9 sync end of GREEN voice line.

5. Telemetry events messages, transmitted by voice and TTY should read:

"JETLAB DE CAPJET (TIME GMT)
ITEM NO.____ (TIME) SECONDS"

6. Burroughs data (to be resolved).

NOTES:
a. All TTY heading times are GMT.
b. All telemetry events time in seconds from liftoff.
c. All TTY reports will be transmitted on Raw Data TTY circuit.
d. All voice reports will be transmitted on GREEN voice net.

D. Priorities: TTY

1. IPP computed data has top priority on TTY circuits. If computed data TTY net fails, RAW TRACKING DATA TTY net will be used. In this case, near real time transmission of RAW TRACKING DATA will be accomplished with commerical TWX.

2. Telemetry events will be transmitted on RAW TRACKING DATA TTY net and will precede over raw data. Exception: If Cape 7090 malfunctions, raw data takes precedence.

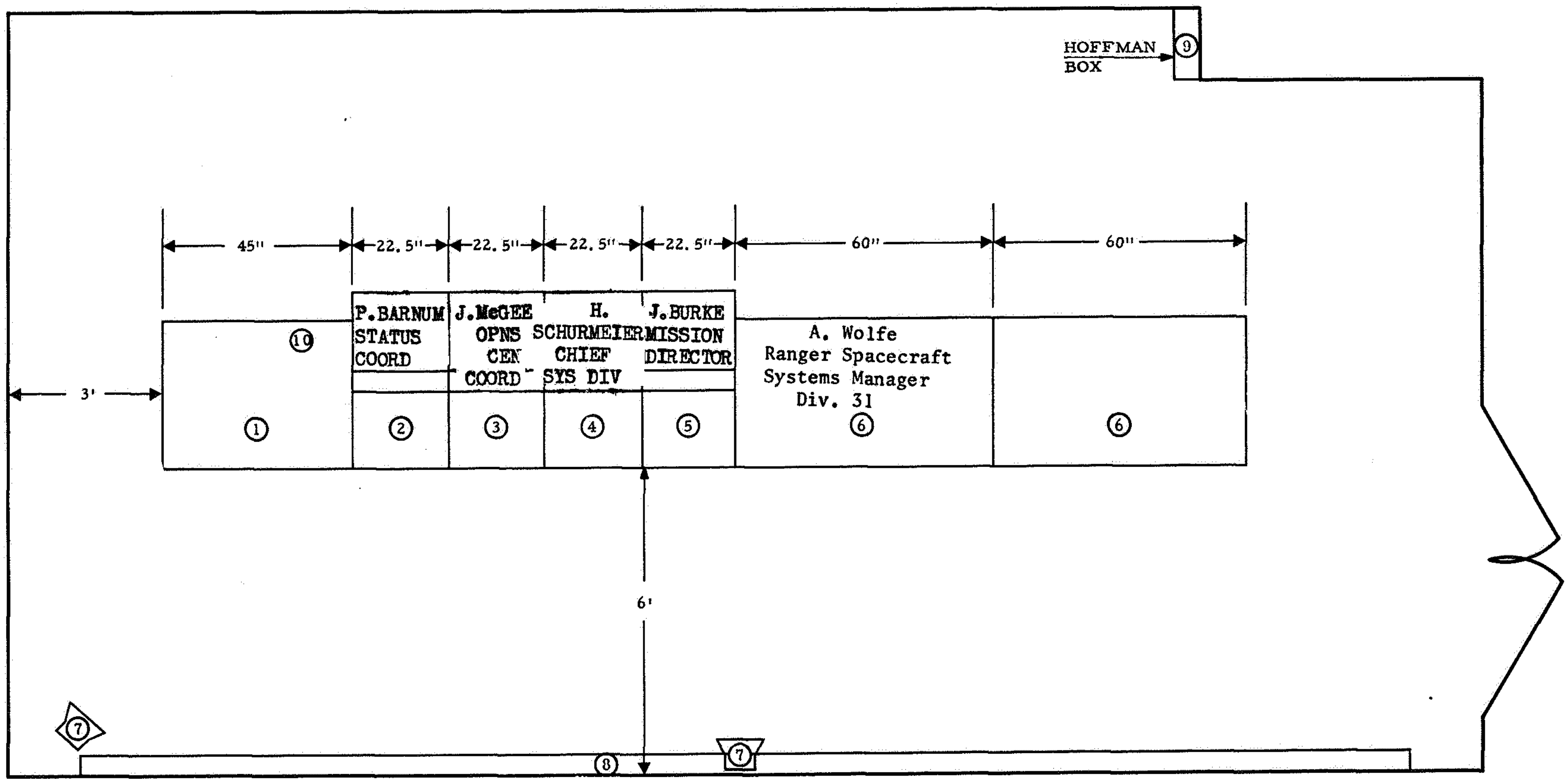
3. If raw data is not available from Antigua, Range ship or Pretoria, raw data will be transmitted to JPL near real time on RAW TRACKING DATA TTY net.

E. Priorities: VOICE

1. Prior to liftoff, GREEN voice net has priority. However, if RED voice net fails, the necessary coordination can be accomplished on the GREEN voice net.

2. After liftoff RED voice net has priority. Again, if GREEN voice net fails, required transmissions can be accomplished on the RED voice net.

3. The Project Manager's net or commercial telephone can be used in all emergencies.



NOTES:

1. 45" CONFERENCE TABLE
2. STATUS CORD, CONSOLE
3. CONTROL CENTER CORD. CONSOLE
4. BLANK CONSOLE
5. MISSION DIRECTOR CONSOLE
6. 60" CONFERENCE TABLE (CFE)
7. COUNTDOWN & PAGING SPEAKERS
8. STATUS BOARDS
9. CABLES INTO ROOM TERMINATED AT HOFFMAN BOX. ADDITIONAL CABLES REQUIRED TO GO TO CONSOLES. AND 10 WITH CONNECTORS ON BOTH ENDS

Figure 8. JPL MISSION OPERATIONS CENTER (MOC) FLOOR PLAN

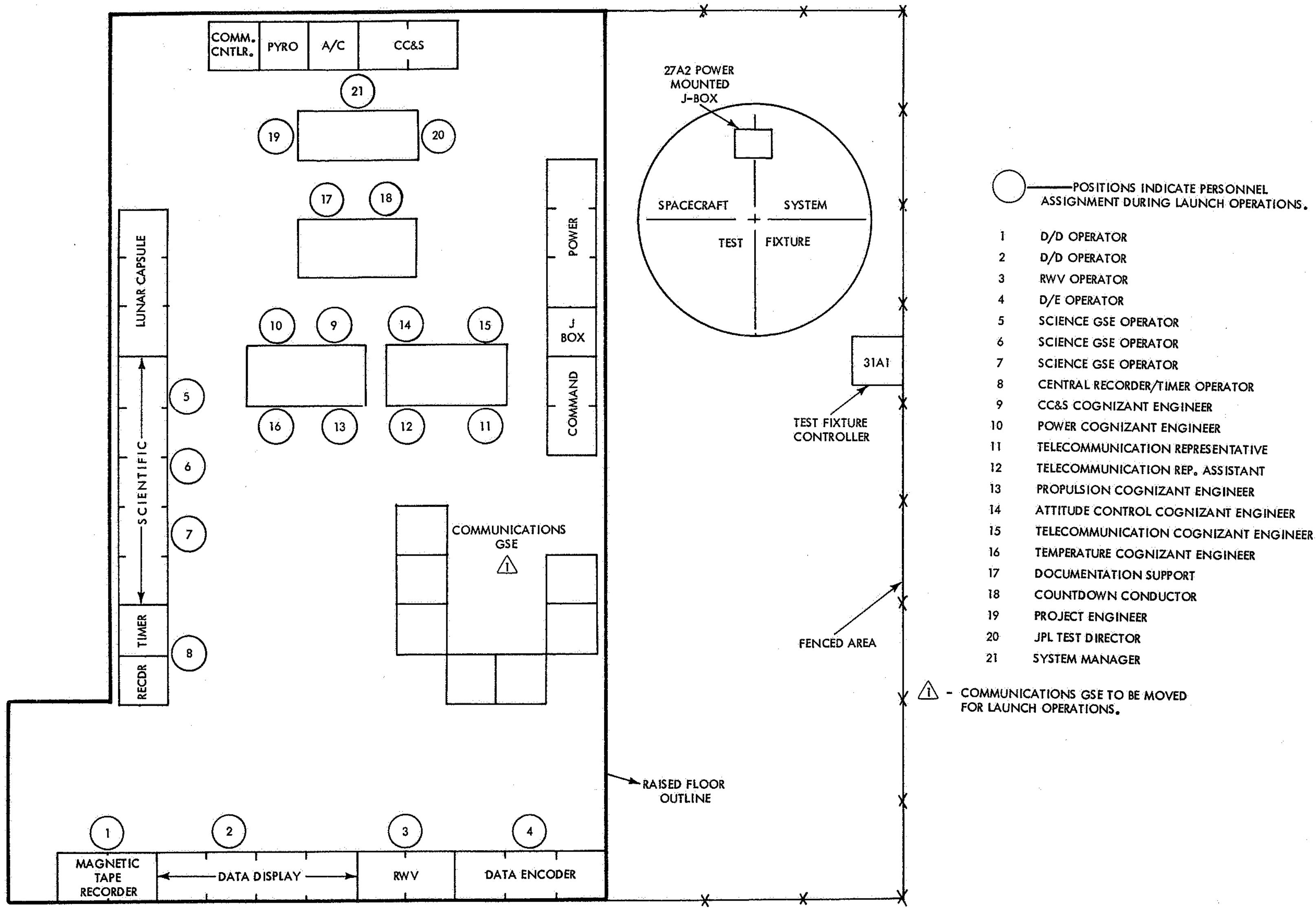
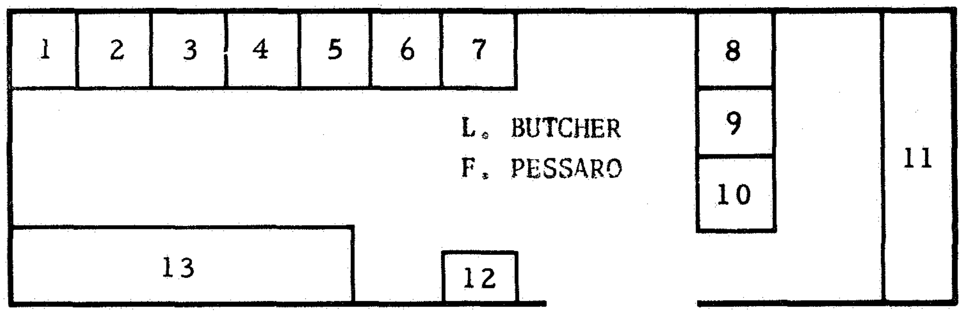


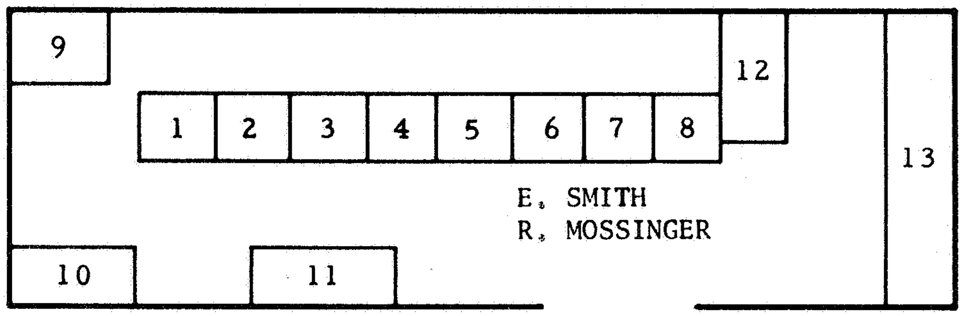
Figure 9. SYSTEM TEST COMPLEX LAYOUT FOR SYSTEM TEST & LAUNCH OPERATIONS, HANGAR "AE", AMR



NOTES:

1. STORAGE
2. STORAGE
3. COMMAND EQUIPMENT
4. TRANSMITTER POWER SUPPLIES AND TERMINAL BOARDS
5. COMMUNICATION RECEIVER
6. COMMUNICATION TEST EQUIPMENT AND RECEIVER POWER SUPPLIES
7. COMMUNICATION TRANSMITTER
8. COMMUNICATION CONSOLE
9. COMMUNICATION CONSOLE
10. COMMUNICATION CONSOLE
11. DESK
12. POWER PANEL
13. WORK BENCH AND STORAGE

FIGURE 10. DSIF NO. 0 RF TRAILER FLOOR PLAN AND PERSONNEL ASSIGNMENT DURING LAUNCH



NOTES:

1. RACK NO. 1 - DIRECT-WRITE OSCILLOGRAPH
2. RACK NO. 2 - POWER SUPPLIES, DISCRIMINATORS, VOLTAGE CONTROLLED OSCILLATORS
3. RACK NO. 3 - POWER SUPPLIES, DC VOLTMETERS
4. RACK NO. 4 - DECOMMUTATOR, PRINTER, WWV TIME
5. RACK NO. 5 - TIME CODE GENERATOR, FREQUENCY STANDARDS, BATTERIES
6. RACK NO. 6 - NEMS-CLARKE RECEIVER, INTERCOM, SPEAKERS
7. RACK NO. 7 - AMPEX TAPE RECORDER
8. RACK NO. 8 - AMPEX TAPE RECORDER
9. WORK BENCH DEHUMIDIFIER
10. POWER REGULATOR
11. WORK BENCH
12. DESK
13. WORK COUNTER, PARTS DRAWERS

FIGURE 11. DSIF NO. 0 TELEMETRY TRAILER FLOOR PLAN AND PERSONNEL ASSIGNMENT DURING LAUNCH

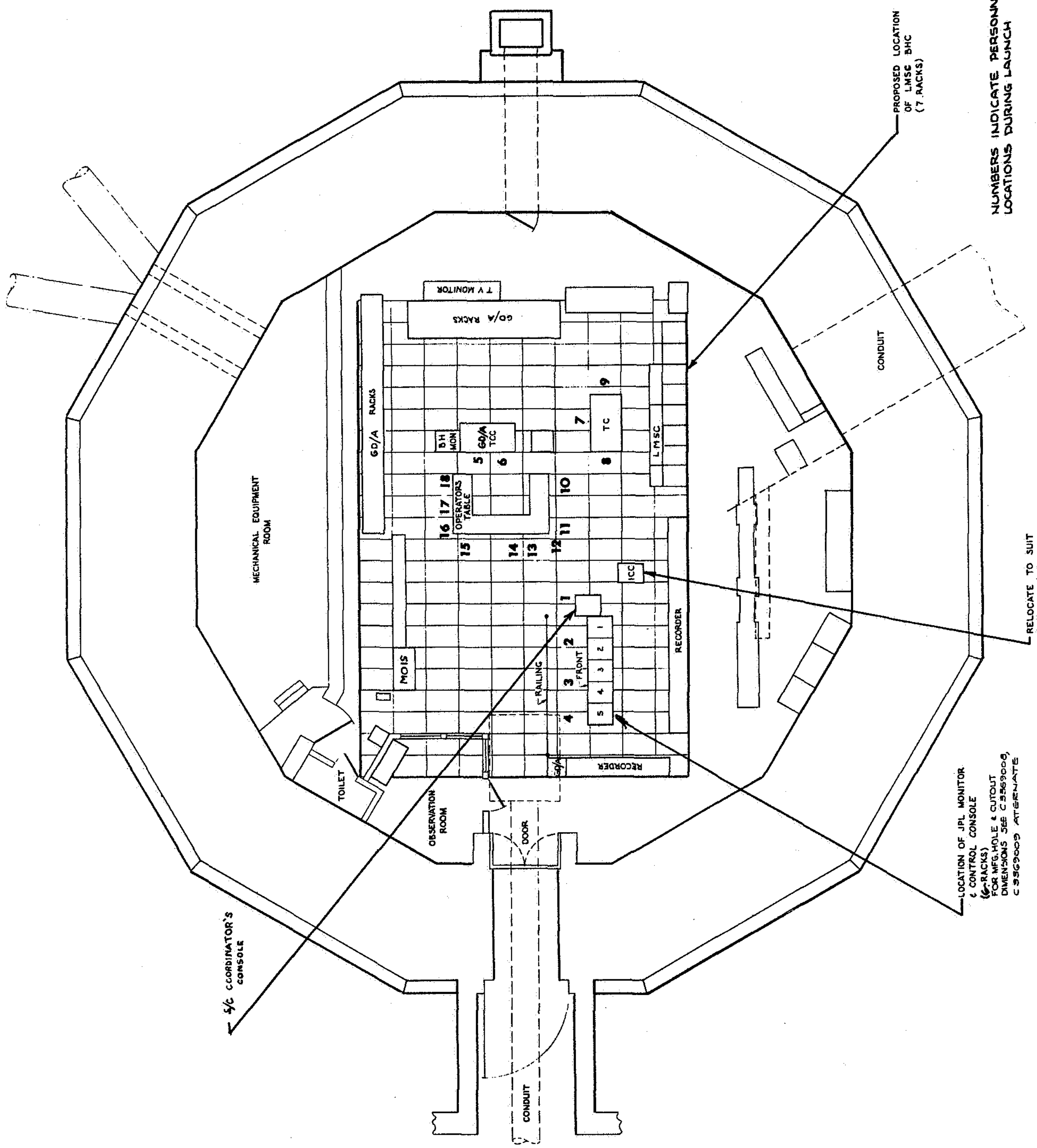


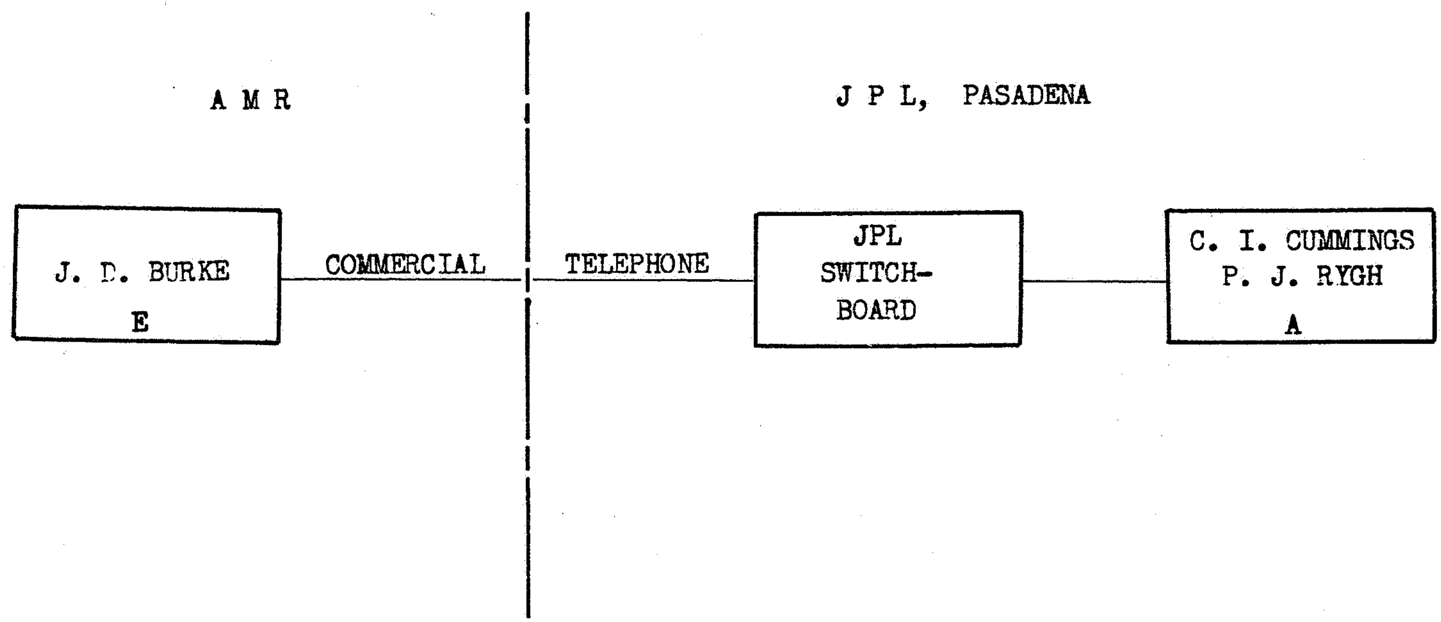
FIGURE 12. BLOCKHOUSE PLAN VIEW, LAUNCH COMPLEX 12, AMR.

TABLE 2. BLOCKHOUSE PERSONNEL ASSIGNMENT DURING LAUNCH

1. G. McDonald, Spacecraft Coordinator
2. W. Harrer, JPL Attitude Control
3. M. Kelly, JPL Data Display
4. J. Cobb, JPL Data Encoder
5. O. Reed, GDA Test Conductor
6. T. O'Malley, GDA Chief Test Conductor
7. R. Zeller, LMSC Test Engineer
8. C. Stevens, LMSC Assistant Test Engineer
9. O. Berger, LMSC AMR Engineering Manager
10. J. Vivera Ass't Test Conductor, Complex, GD/A
11. C. Cope, LOD Ranger Project Coordinator
12. E. Ward, LOD, NTSO, Project Officer
13. K. Debus, NASA/LOD Operations and Test Director
14. Maj. J. Mullady, Test Controller (AF)
15. Capt. J. Deutsch, Complex Officer (AF)
16. Maj. C. McCarthy, Chief of Test Operations (AF)
17. W. Phillips, GDA Assistant Test Conductor, Vehicle
18. H. Levy, JPL Blockhouse Representative
19. Lt. J. Freer, AGENA Project Officer (AF)

GDA - General Dyanmics Astronautics
(Formerly Convair Astronautics)

LMSC - Lockheed Missiles and Space Company
(Formerly Lockheed Missiles and Space Division)



STATION SYMBOLS:

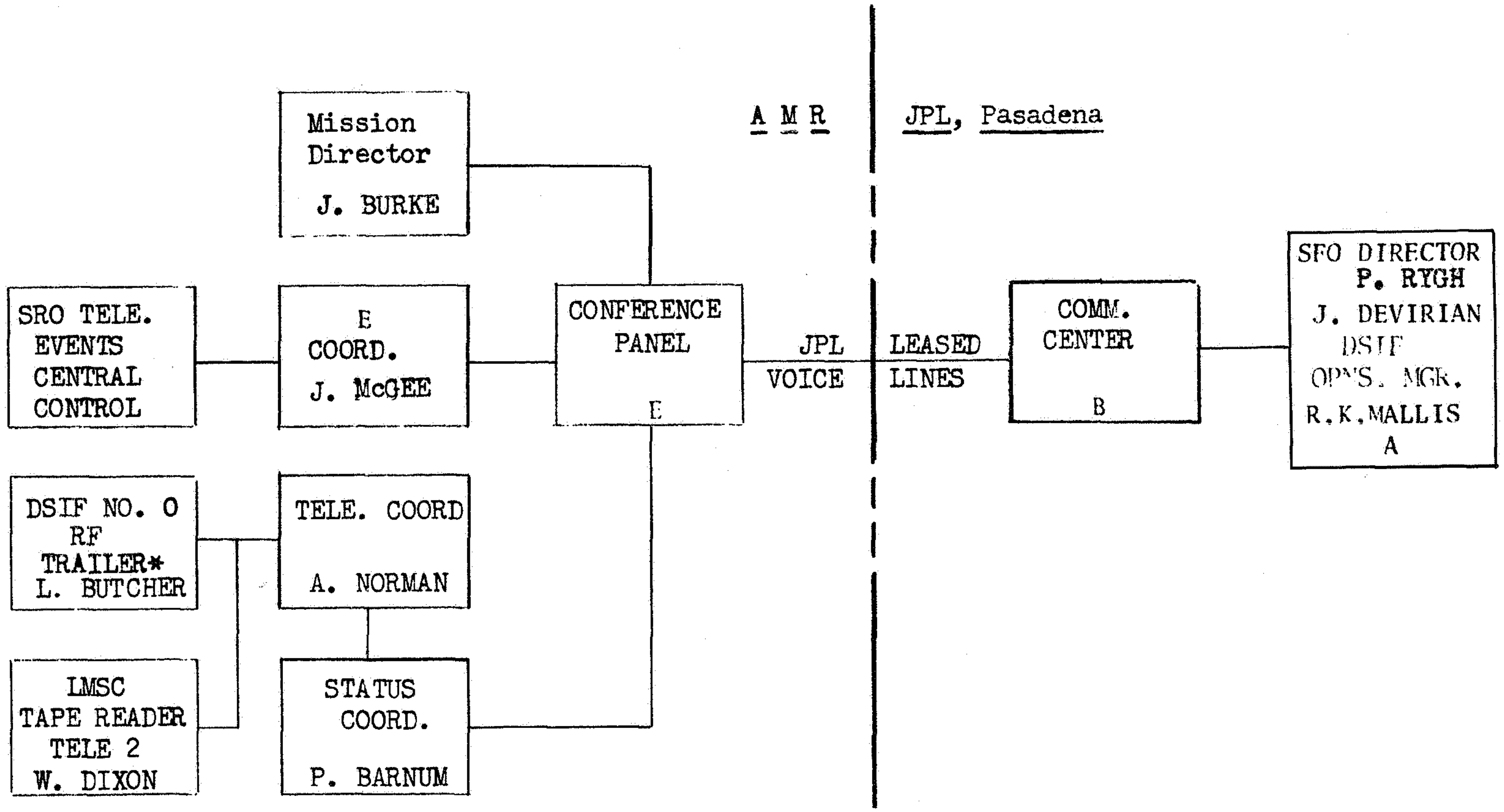
A - JPL SPACE FLIGHT OPERATIONS CENTER, PASADENA

E - JPL MISSION OPERATIONS CENTER, HANGAR AE

NOTE:

COMMERCIAL CALL PLACED AT T-110M THROUGH T+60M FROM CCMTA TO JPL AND CONFERENCED AT JPL SWITCHBOARD TO A. PHONES WILL NOT BE MANNED CONTINUOUSLY. PAGING FOR PHONES WILL BE ACCOMPLISHED ON THE GREEN VOICE NET. THIS THIS NET WILL BE USED AS A PRIVATE LINE AS INDICATED.

Figure 13. PROJECT MANAGER'S NET (T - 110M to T + 60M).

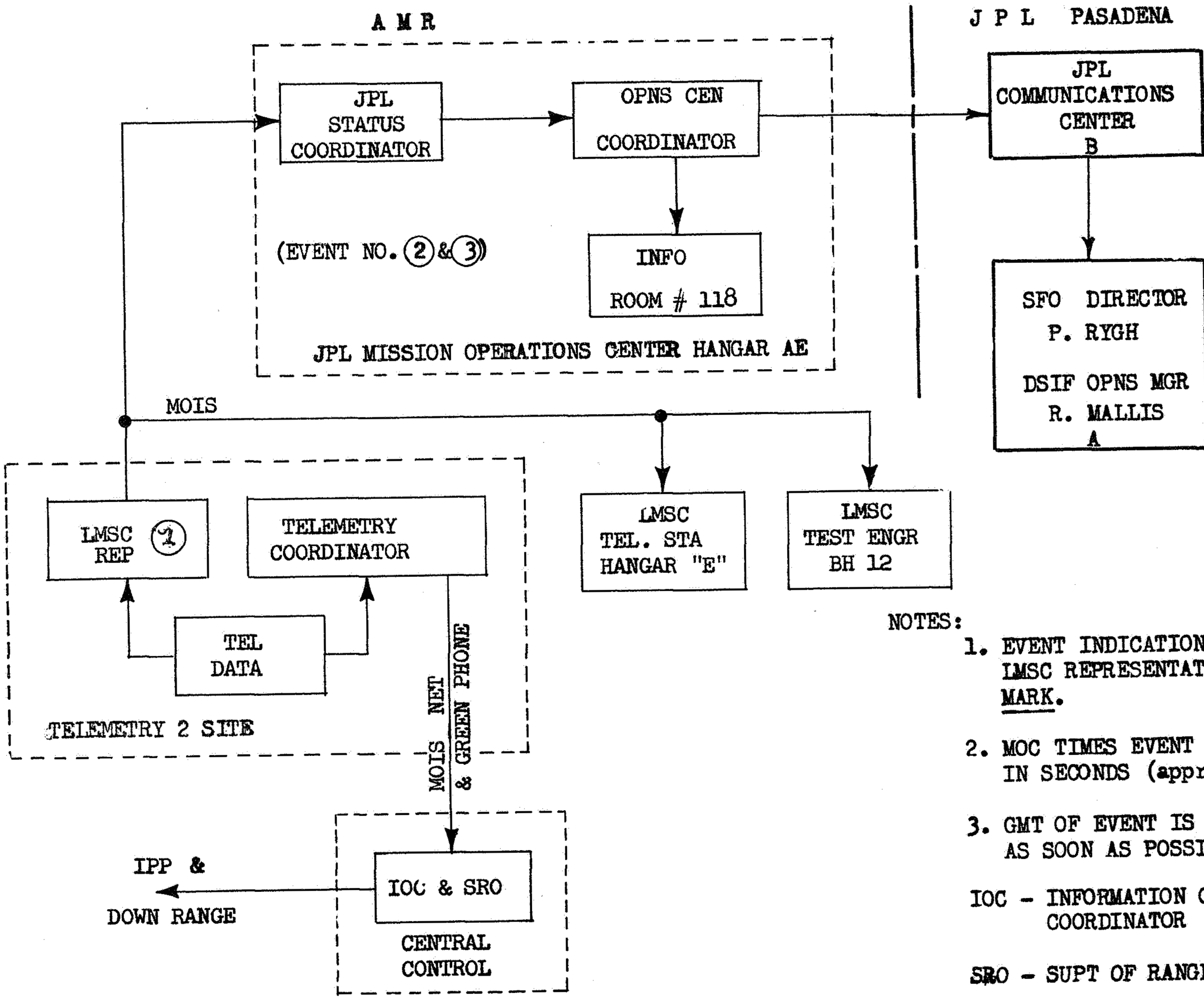


VOICE NET USES:

1. Countdown status for vehicle, Range support, DSIF & A (includes HOLDS).
2. Inflight telemetry events, from TELE 2 until loss of signal and then from SRO for down-Range status.
3. MD uses line as backup to Project Manager's net.
4. SC uses line only as backup to "E" coordinator.

*5. Spacecraft transponder and beacon frequencies & conditions received from DSIF No. 0 RF Trailer.

Figure 14. GREEN VOICE NET (T - 205M to T + 180M)



NOTES:

1. EVENT INDICATION ANNOUNCED BY LMSC REPRESENTATIVE ON MARK.
2. MOC TIMES EVENT (FROM LIFT OFF) IN SECONDS (approx).
3. GMT OF EVENT IS READ AND PASSED AS SOON AS POSSIBLE THEREAFTER.

IOC - INFORMATION OPERATIONS COORDINATOR

SRO - SUPT OF RANGE OPERATIONS

Figure 15. TELEMETRY FLOW CHART, AMR STAT ON (1)-TELEMETRY (2) SITES.

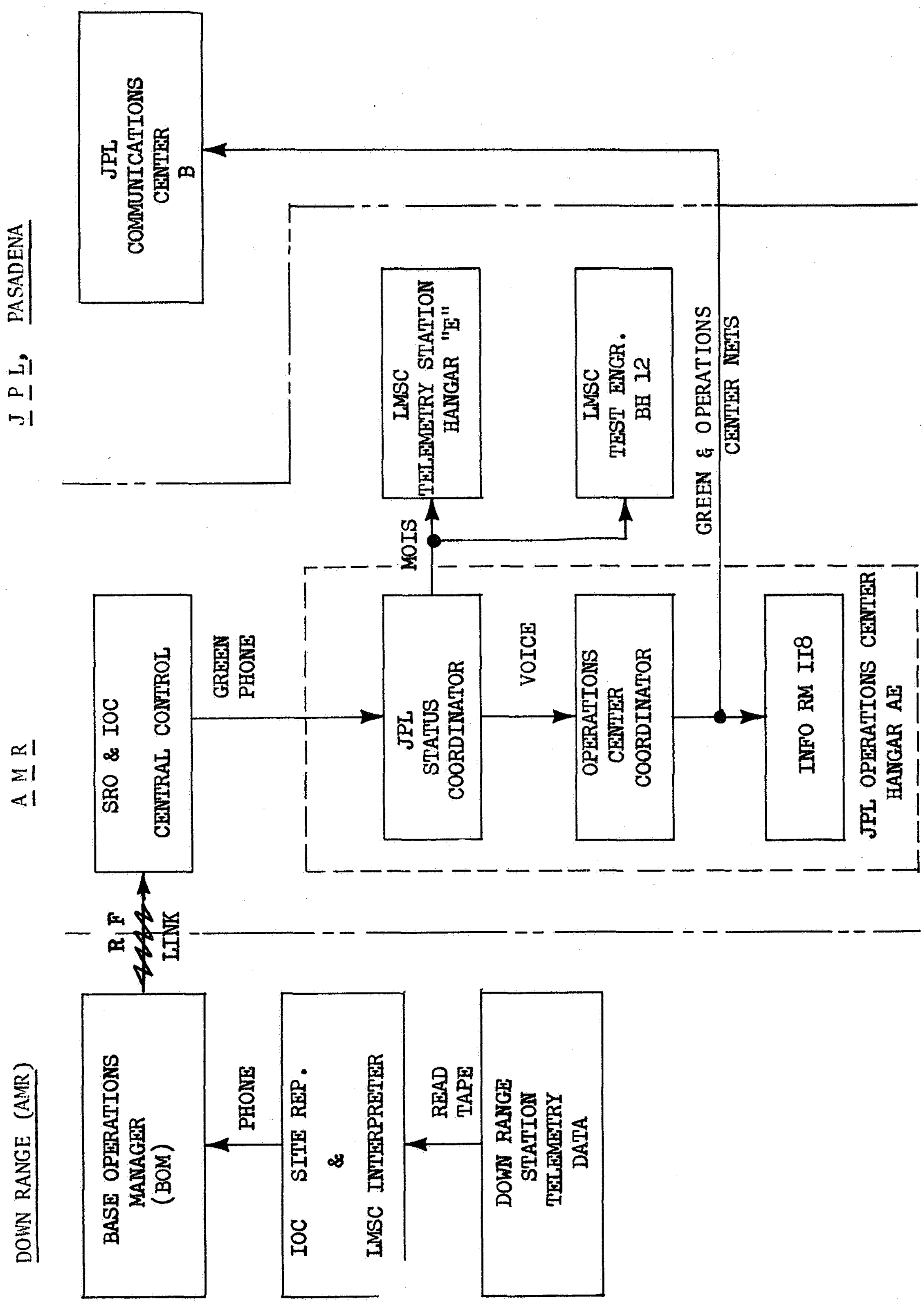


Figure 16. AMR - DOWN RANGE TELEMETRY FLOW CHART.

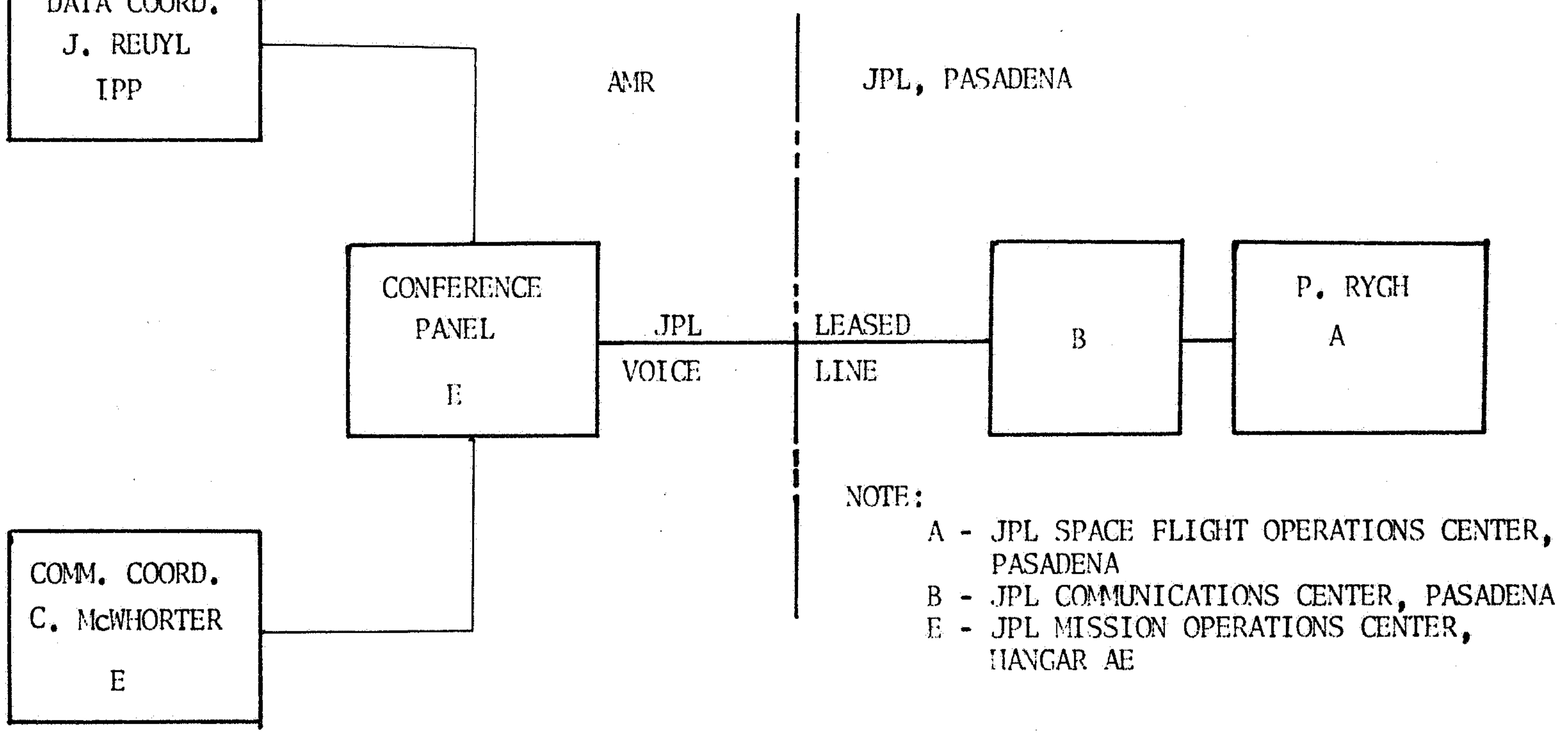
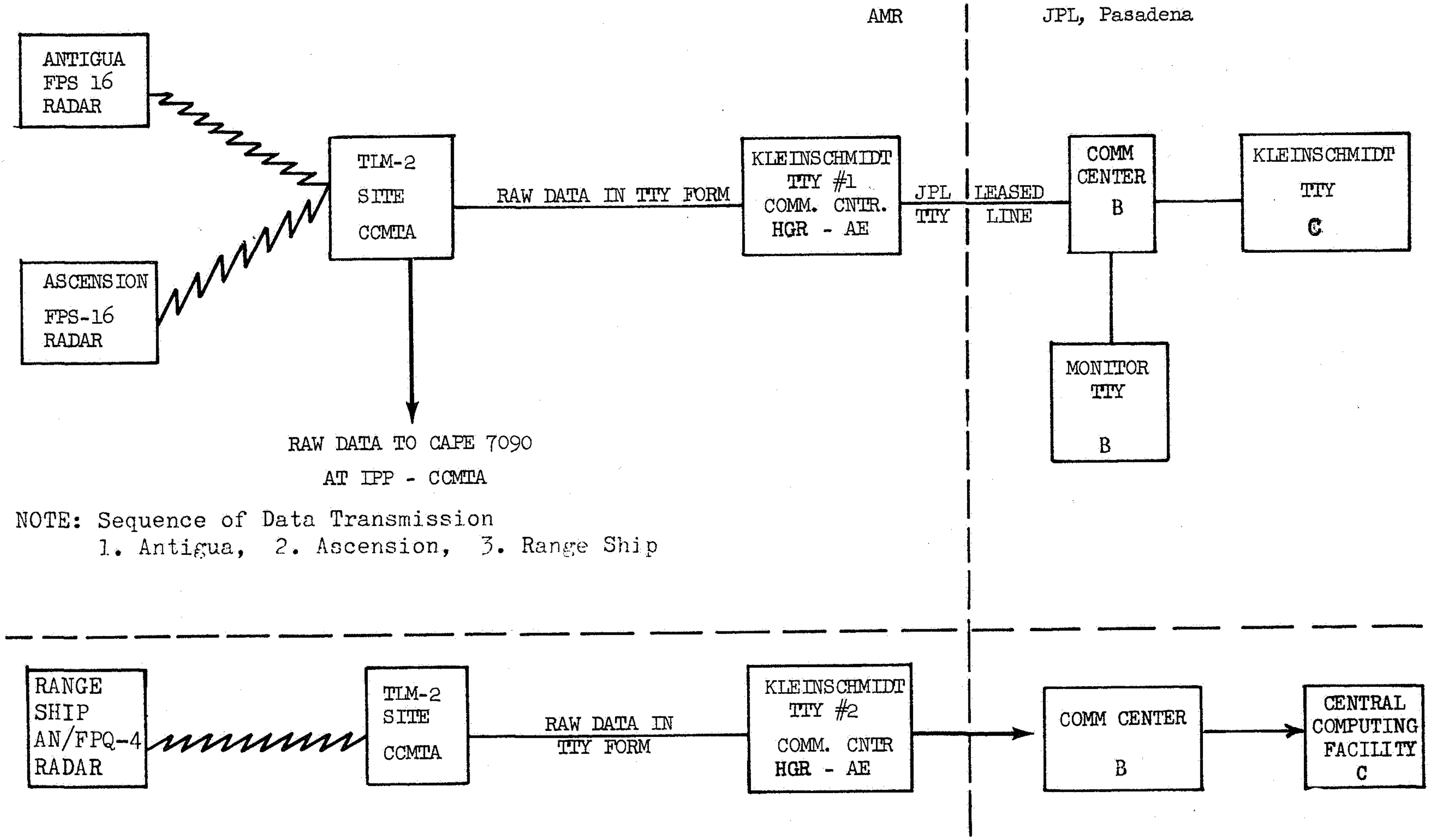
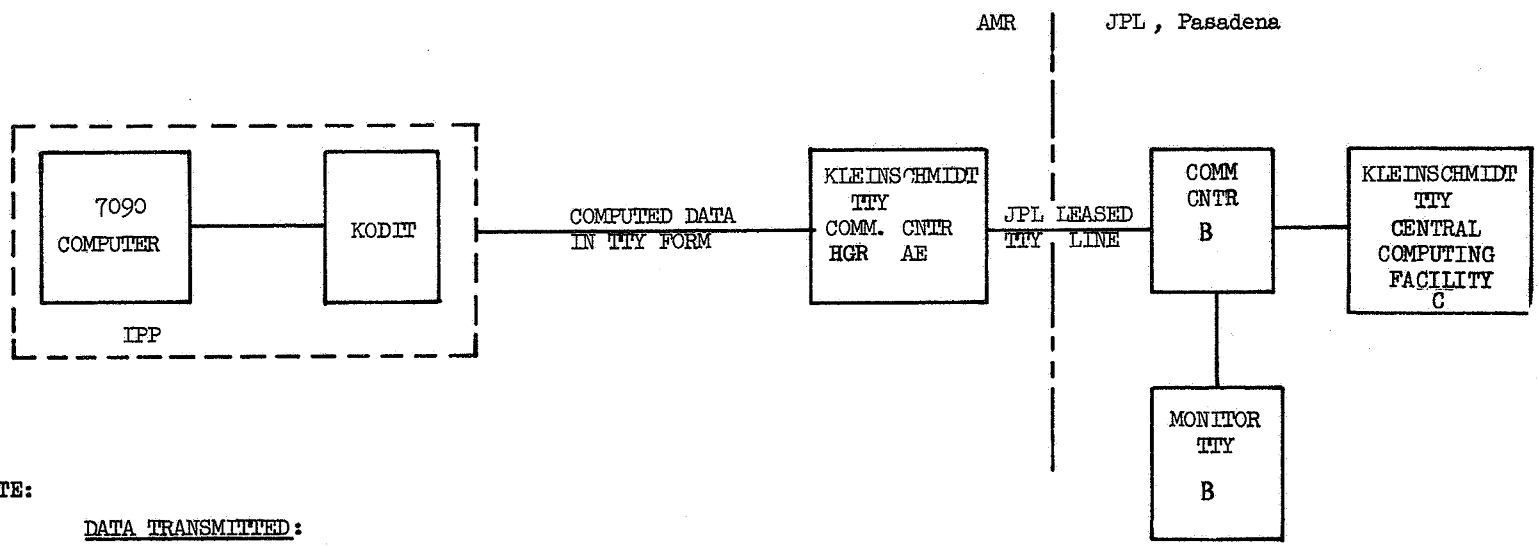


Figure 17. RED VOICE NET FOR COORDINATION BETWEEN CAPE CANAVERAL & JPL 7090 COMPUTER, TRACKING DATA MODE (T-15M to T+60M).



NOTE: Sequence of Data Transmission
1. Antigua, 2. Ascension, 3. Range Ship

Figure 18. TRACKING DATA TELETYPE NET, RAW DATA TRANSMISSION MODE
(T - 15M to T + 30M)



NOTE:

DATA TRANSMITTED:

1) PARKING ORBIT ELEMENTS

2) ACQUISITION DATA

Figure 19. COMPUTED TRACKING DATA NET, COMPUTED DATA TRANSMISSION MODE (T - 15M to T + 60M)